SIXTY-NINTH YEAR

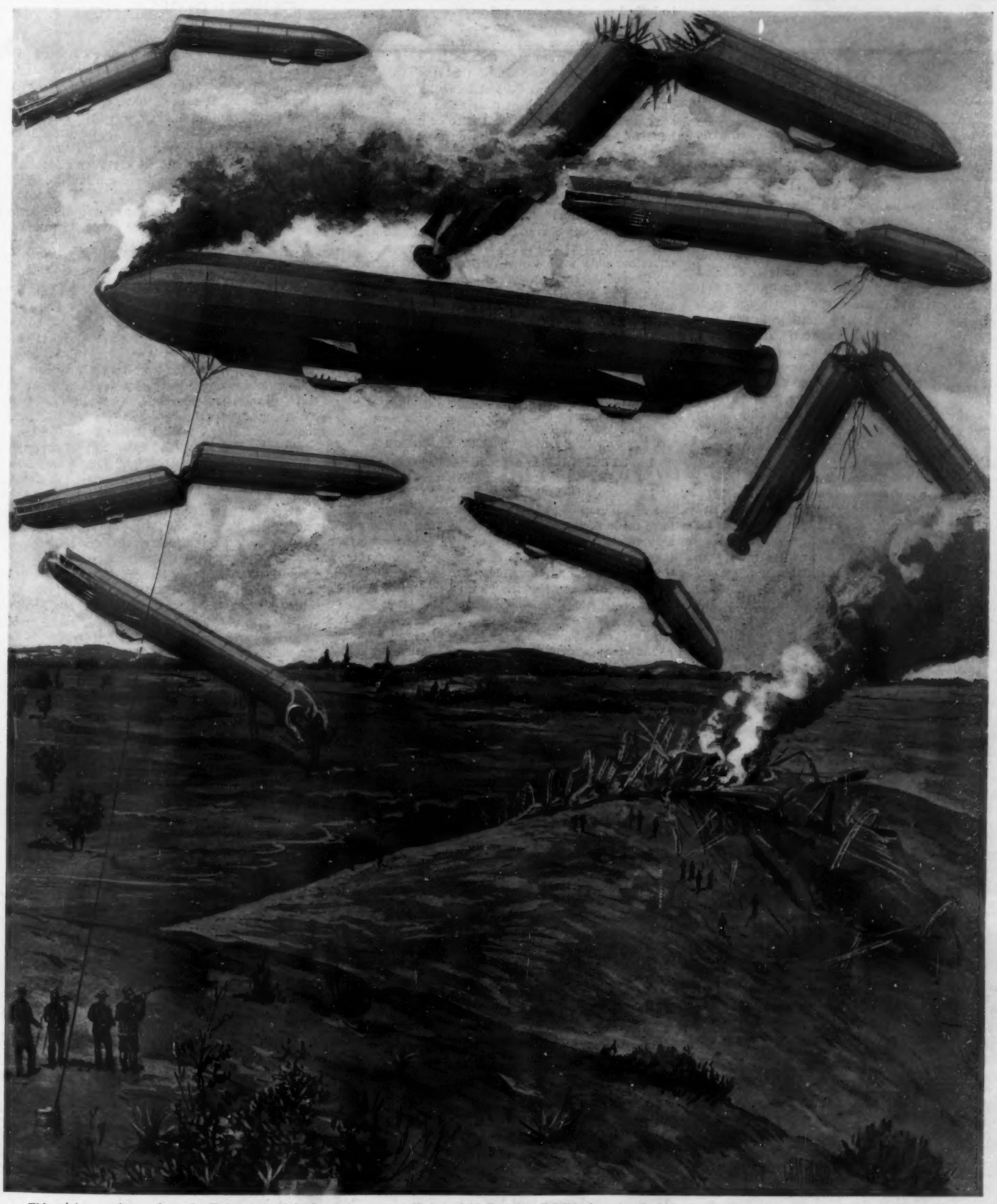
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CIX
NUMBER 7.]

NEW YORK, AUGUST 16, 1913

[PRICE 10 CENTS
$3.00 A YEAR



This picture, redrawn from *La Nature*, would lead one to suppose that a rigid Zeppelin dirigible is not safe high in the air. As a matter of fact, nearly all the Zeppelin accidents have occurred on the ground.

A FRENCH CONCEPTION OF ZEPPELIN FRAILTY.—[See page 126.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, AUGUST 16, 1913

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year $5.00
Postage prepaid in United States and possessions, Mexico, Cuba, and Panama

Subscriptions for Foreign Countries, one year, postage prepaid. 6.50
Subscriptions for Canada, one year, postage prepaid. 5.75

The Scientific American Publications

Scientific American (established 1845) . . . . . per year. $5.00
Scientific American Supplement (established 1876) . " " 5.00
American Homes and Gardens . . . . . " " 5.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application.
Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Sea-level Canal Fallacies

THE rapid increase which is taking place in the dimensions of the largest steamships built for the Atlantic trade—the fact that vessels exceeding 900 feet in length are now either actively engaged in service, or are approaching completion by the builders, has led to a revival in the public press of the arguments which were used several years ago in favor of building a sea-level canal at Panama. Attention is drawn to the fact that since the "Imperator" is 900 feet in length over all, and the "Vaterland," which will visit this port next spring, will be 940 feet in length, and a third vessel, now on the stocks, will be even longer, the time is approaching when the usable length of 1,000 feet of the locks of Panama will be found insufficient to accommodate the largest ships of the merchant marine.

Would it not have been wiser, say the critics, to have built the Panama Canal at sea level and thus have provided a channel, free from obstruction, through which the world's shipping could pass at any time without let or hindrance?

Now the pros and cons of this problem were very thoroughly entered into by the Isthmian Canal Commission when it was preparing data for the guidance of Congress in reaching a decision as to whether the canal should be built with locks or at sea level. So far as the professional mind is concerned, we doubt if any engineer could be found to-day who would advocate the construction of a sea-level canal at Panama; but since the question has been raised and agitated in the lay press, we will re-state, briefly, the conditions which render a canal at sea level both technically and commercially impossible.

In the first place, then, let it be clearly understood that any kind of a canal at Panama must perforce be provided with locks; and this for the reason that the great difference in level of the Atlantic and Pacific oceans renders at least one set of locks necessary. The extreme rise and fall of the tide at Colon on the Atlantic is about 2 feet; at Panama on the Pacific it is about 22 feet. At mean tide the two oceans are at the same level, but at extreme high tide the water at the Pacific end is 10 feet higher than that at the Atlantic end, and at extreme low tide, it is 10 feet lower. If no regulating locks were established, let us say at the Panama entrance, the difference in level at high tide would cause a heavy current to set up in the Canal from the Pacific to the Atlantic, and at low tide there would be a heavy current in the reverse direction. This would render navigation difficult; for should a ship say 600 or 700 feet in length make a sudden swerve for either bank when she was breasting this current, it would be difficult to prevent her taking the ground. A single flight of locks at the Pacific end would be an absolute necessity.

The Panama Canal locks are 1,000 feet long and 110 feet broad, and the largest ship built to-day is 940 feet long and 100 feet broad. A ship of this size, then, could use the Canal comfortably, since it would be taken through under the absolute control of four powerful, electric, towing locomotives. We think it is very doubtful if these dimensions will be exceeded for many years to come; but even if they should be, and vessels of 1,000 feet length should be built, they would have no relation to the problem under consideration; and this for the reason that ships of this size are built solely for the heavy transatlantic passenger traffic, and only in such service can they possibly be made remunerative. Not within the life-time of the youngest child that can spell out what is here being written, will there be a call for such ships on the various routes which seek or will seek to pass through the Panama Canal.

Nature itself, however, has decreed that no sea-level canal shall ever be constructed at this Isthmus; and its fiat is to be read in those enormous masses of unstable material which, unsettled in their age-long equilibrium by the digging and delving of man, are now moving slowly but with irresistible force into the canal prism. The problem of removing this material is very serious, it is true; but the skill and resources of the engineer are equal to the task. The Canal will be opened on time; an unobstructed channel for the passage of ships will be maintained; and the work of transporting the débris will continue, until the last cubic yard has slipped into the channel and been removed. Then, when the angle of repose that has been ordained by nature has been reached, the Canal may be looked upon as a completed work.

We are speaking, however, of a lock canal with its surface 85 feet above the surface of the adjacent oceans. If our engineers were now engaged in constructing a sea-level canal, the bottom of the excavation would have to be carried down 85 feet below its present level, and throughout the whole nine miles of the Culebra section an enormous additional slice of material would have to be taken off the slopes on either side of the canal prism. It does not take a professional mind to understand that sliding, which is so serious in a cut of the present depth, would become absolutely overwhelming were that cut carried 85 feet farther down, and the equilibrium of the mountain divide proportionately disturbed. As matters now stand, sliding has been such that at one point, where the proposed slopes on either side were three vertical to two horizontal, the flow of the treacherous material has been such that the present slope is one vertical to seven horizontal, and the width of the cut at the natural surface of the ground has widened out from 670 feet, as planned, to a present width of 1,800 feet.

In view of such conditions as now exist, it would not take a bold prophet to state that if the canal were cut through the divide down to sea level, both the time and the cost of construction would be doubled.

Japan's Battle-cruiser Squadron

ASTUTENESS is a pronounced characteristic of the Japanese character, and nowhere is the sagacity of this people shown to such good effect as in the up-building of their navy—in which enterprise they have made few, if any, mistakes. Hence, we may rest assured that it was not without very good reason that the Japanese Government entered upon the construction of the four powerful and very costly battle-cruisers, the first of which forms the subject of illustration and comment on another page of this issue. Our Navy Department, it is true, regards with disfavor any proposal to build high-speed battle-cruisers for our service; holding that, in view of the limited appropriations which are available, it is best to put such moneys as are appropriated into battleships carrying the heaviest armor; since it is by such ships that the final decisive stroke of a naval conflict must be given.

It may be that the Japanese strategists, having in view the conditions which would prevail in the event of hostilities with the United States, believe that they could deal the most telling blows if a considerable part of the displacement of their new construction were embodied in a number of ships of great gun power and of sufficient speed to elude our battleship fleet and accept or evade an engagement as the conditions seemed favorable or otherwise to their success.

No one who makes a study of the "Kongo" and her three sisters will deny that the quartette will add to the Japanese Navy four identical ships whose potentialities are very formidable indeed. A squadron whose batteries aggregate 32 of the most powerful naval guns afloat, and whose speed is such that these batteries can be carried from point to point at 28 knots sustained sea speed, and whose fuel supply of 5,000 tons of coal and oil will be sufficient, surely, to enable them to cross the Pacific and return without replenishment, forms a fighting unit which may well give our naval strategists at Washington cause for serious reflection.

Gun for gun, armor for armor, a "Kongo" with an advantage of over 50 per cent in sea speed, should prove more than a match for any of our battleships anterior to the "Delaware" and "North Dakota;" moreover, the Japanese admiral would not hesitate to place these four ships in line for a fleet action, where, although they could give more than they could take, the excellent distribution of their nine to ten-inch armor, coupled with the heavy protective bulkheading, would enable them to stand some very heavy punishment.

The speed, the extraordinarily wide range of action due to their enormous fuel supply, and the great range and power of their batteries, would make the existence of such a fleet, in the event of hostilities, a hard nut for strategists to crack. They would render the conveying of troops across the Pacific, except by ships of the line, an utter impossibility; and with the assistance of colliers meeting them at points of rendezvous, such a squadron might work havoc to our sea coast cities. In any case it is certain that they might impose a heavy burden on the Navy, through the fears which they would excite of bombardment, and the inevitable demand which would be made in Congress for the detailing of at least a portion of our battleship fleet for coast-defense duty.

On the other hand, we hear rumors from Great Britain that the battle-cruiser type is to be discontinued, or rather, that it is to be merged with the parent battleship in a new type, combining the speed of the one with the high offensive and defensive qualities of the other.

The History We Want to Read

PEACE is the child of war. The present generation is enjoying, throughout the most highly civilized portion of the earth, a period of quiet and peace such as is perhaps unprecedented in the history of the world. Not that all war has ceased—a look at the newspapers is enough to convince us of the contrary—but such wars as have been waged within the last forty years or so have not—in the Western World at least—drawn flame and sword through our very hearths and homes, have not even disturbed industrial and mercantile pursuits in any very distressing measure: The arts of peace have continued comparatively undisturbed.

Thus a generation has sprung up for whom war and military pursuits are of academic rather than of vital interest. But the writing and teaching of history has lagged behind the general spirit of our time. The scholastic historian is often still content to recount for us the catastrophes and intrigues which convulsed the nations in their struggle for light and life. For the truly essential factors of human life—industry, commerce, economic conditions, science and art—these "historians" have at most a passing reference here and there. But, it may be urged, such topics are reserved for specialists, for works on the history of industry, art, science, and so forth. The retort is: Then the history of wars belongs to the specialist in military science. Surely *his* field is more remote from general interests, at the present day, than that of the manufacturer and merchant. If, therefore, the general history written and taught for the benefit of the general public, is to borrow (as it must) from special fields, surely it is more natural that it should select chapters from the history of science, art, and political economy, than from the records of war.

We may compare the wars through which a nation passes in the course of its evolution, to the sicknesses with which an individual battles on his way through life. What would we say of the author who should write the biography of some great man, and content himself with an account of his struggles with the measles, croup, and other ailments which he successfully encountered, until at last the grim enemy won his accustomed victory? Such an account might indeed be of interest to a specialist—to the medical practitioner. To any other person it would appear nauseating. But this is precisely what the average historian does in relating the life history of nations. One would almost think that war was the chief end of human existence!

And there are so many things which we, the reading public in the twentieth century, would like to know from the historian. When did men begin to mine coal? When and how did money come into general use? How much gold has been in circulation in the several civilized countries of the past, and how have the figures changed, and what are they now? To-day the population of the United States is about ninety-one million souls, that of Germany sixty-five millions, of the British Isles forty-five millions, of France thirty-nine millions. But how did they stand relatively ten, twenty, thirty years ago? Who would say that this is a matter of indifference to the nations concerned?

But above all, let not history be a mere narrative, a collection of pretty stories and romantic adventures—though romance has its place in history—but let us have a sober account of the history of mankind, which is nothing more nor less than a natural phenomenon. Let not history be presented as a series of causally disconnected events, determined by the caprice of favored individuals, but as an orderly sequence of steps in a process of evolution governed by the inexorable laws of nature.

Round the World in Thirty-six Days.—By making the circuit of the world in 35 days 21 hours and 35 minutes, J. H. Mears, representing the New York *Evening Sun*, has reduced the record by nearly four days below that made by A. Jaeger-Schmidt in 1911. This meritorious achievement was greatly assisted by the hearty co-operation of the various transportation companies, who by means of special trains endeavored to reduce delays due to unavoidable accident.

Engineering

Progress in Panama.—The grand total of canal excavation to July 1st was 203,383,539 cubic yards, leaving to be excavated 14,812,034 cubic yards. The total excavation for the month of June was 2,659,424 cubic yards, as compared with 2,339,770 cubic yards for the corresponding month last year.

Electrically-refined Steel for Automobiles.—Apropos of the recent article in the SCIENTIFIC AMERICAN on the growth of electrical refining of steel, we note that automobile manufacturers are availing themselves of the new process for the production of mild-steel castings. One of the largest English automobile manufacturers has installed an electric furnace for supplying castings of this kind for machines made at his factory.

The Iron Mining Industry.—Statistics for the year 1909 issued by the Department of Commerce show that there were 483 iron mines in the United States, employing 65,176 persons, and costing for operation and development $74,071,830. The production of iron ore in crude form was 51,947,129 tons, and its value at the mine was $106,539,574.

Appraisal of Our Railroads.—The Interstate Commerce Commission have presented figures to the House Appropriation Sub-committee showing that a carefully worked out estimate places the cost of field work for appraising the value of the railroads in the United States at nearly $2,000,000 per year, and as the work will occupy from five to seven years, the total cost will be from $10,000,000 to $14,000,000.

Final Canal Dredging Operations at Panama.—The various dredging units in the canal service at Panama are to be consolidated with headquarters at Paraiso. The final work at Panama will be done by the two large hydraulic dredges which are nearing completion. The fuel supply for these dredges will be brought from the Atlantic end of the canal in barges, and the fuel oil will be piped into a tank at Paraiso.

Widening a Tube Railway.—The City and South London Tube Railway, the first of its kind to be built in London, is to be widened. Its present width is 10 feet 2 inches, and under the scheme of reconstruction this is to be extended to a width sufficient to accommodate cars of the same size as those that use other and later tube railways. These tubes are cast-iron lined, and their enlargement will call for some interesting reconstruction work.

An Advantage of Railroad Electrification.—An incidental advantage of the use of electric traction on railroads has developed in the freight yard of the New York, New Haven & Hartford Railroad at the Harlem River, New York. The abolition of steam locomotives has so reduced the noise and smoke that land in the vicinity is now being covered with dwelling houses, which formerly was considered, because of these nuisances, to be uninhabitable.

The Increased Size of Destroyers.—That there is a steady growth in the size and the power of the destroyer is evidenced by the dimensions of the latest boats of this type which are to be built for the United States Navy. They will have a length of 310 feet, a beam of 29 feet 10 inches, a draft of 9 feet 3 inches and a displacement of 1,090 tons, with a speed of 29½ knots. Incidentally, there will be a great increase in the cost. Bids for six vessels of this type vary from $859,000 to $924,500 for a single vessel.

Ship's Rudder with a Doorway.—The new Cunard liner "Aquitania," which is about the same size as the "Imperator," is provided with a novel feature in her balanced rudder. This consists of a doorway leading to the interior of the rudder, which is of sufficient size to admit workmen at any time it should become necessary to remove the pin which connects the rudder to the ship. According to the *Shipping World*, this pin is four feet in length and is larger than the heaviest projectile made for modern artillery.

Completing the World's Ocean Survey.—That the work of charting the rocks and shoals which constitute a menace to navigation is not by any means completed is shown by the report of the Navy Hydrographer of the British Admiralty for 1912, in which he states that during the year no less than 509 rocks and shoals were reported. Of this total, 10 were reported by naval vessels, 120 by urveying ships, 9 were found by vessels striking upon them, 59 were reported by various British and foreign authorities, and 311 were reported by colonial and foreign governments.

Ten Years Increase in Steel and Machinery Exports.—The report of the Bureau of Foreign and Domestic Commerce shows that our manufactures for export have risen from a value of $468,000,000 in 1903 to $1,200,000,000 in 1913. Manufactured materials have risen from 409 to 740 millions. Ten years ago iron and steel manufactures exported amounted to 97 millions. This year the total reaches 300 millions. Copper manufactures have gone up from 40 millions to 140 millions and the exports of machinery from 51 to 130 million dollars.

Science

Suffragette Vandalism at an Observatory.—A suffragette bomb (this time a real one) was exploded on May 21st under the west dome of the Royal Observatory, Edinburgh, in immediate proximity to the 24-inch reflector and other instruments. Only the strong floor of the dome prevented serious damage from being done.

Errors in Scientific Tables are the cause of much vexation, and sometimes of grave disasters. In a letter to *Nature* calling attention to a series of errors in the 1896 edition of the Smithsonian Physical Tables, Mr. C. T. Whitmell makes the admirable suggestion that all discovered errors in tables should be sent at once to some official body, which should annually publish corrections of them. Here is a suggestion, realizable with a minimum of labor and expense, of which the scientific world ought immediately to take notice. The International Association of Academies appears to be the body best fitted to handle such an undertaking. (The errors discovered by Mr. Whitmell have been corrected in a later edition of the Smithsonian Tables.)

The International Association of Academies held its fifth meeting in St. Petersburg the middle of May. At the suggestion of the Berlin Academy a committee was appointed to encourage the organization of vulcanological institutes in the various countries; ultimately an international commission will be formed to act as a connecting link between these national bodies. Another committee was appointed to consider the feasibility of introducing a more scientific scale and definition of compound colors than now exists. One of the most interesting topics considered by the association, and ultimately referred to a committee for further attention, was a French scheme for reforming the calendar, according to which Easter would fall on a fixed date and any day of the year would always fall on the same day of the week. The association was lavishly entertained, and the delegates were individually presented to the Czar. The next meeting will be held three years hence in Berlin.

An International System of Pilot-Balloon Stations is a desideratum to which Prof. Hergesell, president of the International Commission for Scientific Aeronautics, has recently called attention. A pilot-balloon carries no basket or apparatus of any kind; it is simply set adrift, and its motion through the air is followed with a theodolite. It thus serves to determine the direction and force of the wind at different levels. In Germany there are upward of fifteen stations at which such observations are made every morning, and Prof. Hergesell urges that other countries establish a corresponding number, in proportion to the extent of their territories. The realization of this project would be not only of great theoretical interest to meteorologists, but also of much practical value to aeronauts. It is understood that about fifty such stations will be established in Russia within the next two years.

The Expedition to Easter Island initiated by Mr. Scoresby Routledge, brief mention of which was made in the SCIENTIFIC AMERICAN of September 21st, 1912, page 239, sailed from Falmouth, England, on March 25th. As previously stated, its object is to study the remarkable stone statues and other remains of an unknown people on this mid-Pacific island. As there is no regular communication with the island, the party goes in a small yacht, chartered for the purpose, and will subsequently make a cruise among the less-known islands of the South Pacific. The expedition is under the auspices of the British Museum and the British Association for the Advancement of Science, is aided by a grant from the Royal Society, and is promised further assistance on the part of the Chilean government and the proprietors of Easter Island. The party comprises, besides Mr. and Mrs. Routledge, Mr. O. C. S. Crawford, of Oxford; Lieut. D. R. Ritchie, R.N.; and Mr. F. Lowry-Corry, of Cambridge.

A Change in Department of Agriculture Publications.—The Secretary of Agriculture has announced a new plan of publication work for his department. The old independent series of bulletins and circulars of the thirteen publishing bureaus, divisions and offices of the department have been discontinued and will be superseded by a new *Journal of Research* for printing scientific and technical matter, and by a department series of bulletins, written in popular language for selected and general distribution. By this plan the confusion that has resulted from the multiplicity of series of publications will be avoided, and the saving of a considerable sum will annually be effected. Under the new plan the department will discontinue the general distribution of matter so scientific or technical as to be of little or no use to the lay reader. It will supply technical information only to those directly interested and capable of using scientific analyses, and of understanding the results of research work couched in scientific terms. A larger amount of information in popular form which the average reader can immediately apply to his own direct advantage, and thereby increase the agricultural productiveness and the health of the nation, will hereafter be distributed.

Automobile

Heating the Steering-wheel Rim.—To avoid the difficulties resulting from a cold-steering wheel, Rueben S. Smith of Marshall, Texas, in a patent, No. 1,062,745, arranges an electric heater of a special construction described in the patent, in the hollow rim of the handle wheel, so that the rim will be heated electrically.

Two Patents to Howard E. Coffin.—Howard E. Coffin of Detroit, Mich., has secured two patents, Nos. 1,060,819 and 1,060,820, relating to starting devices for explosion engines in which compressed air is utilized by a novel valve arrangement in securing the automatic starting of the engine.

Head Lamps That Shift Automatically.—In a patent, No. 1,063,952, Charles C. Bruff of Coalport, England, mounts the head lamps of automobiles with vertical reflectors which can be rotated in front of the lamps and are automatically and simultaneously rotated in accordance with the turning of the automobile so that the beam of light from each lamp is divided and an area is illuminated which extends both directly in front of the vehicle and in the direction in which the vehicle is being turned.

A Bell That Rings When the Tire is Deflated.—Hermann Jacoby of Eberstadt, near Darmstadt, Germany, in a patent, No. 1,062,567, shows in connection with a pneumatic tire, a bell and a spring actuated sounder, therefore, normally clear of the bell, and having a portion projecting relatively near to the ground surface and alongside the tire, so that any unusual deflation of the tire will cause the said part to strike the ground and result in a sounding of the bell.

A Novel Anti-skid Device.—A patent, No. 1,062,618, has been issued to Thomas Townend of Winnepeg, Manitoba, for an attachment to automobile wheels wherein it is sought to prevent the wheel from skidding or sliding sidewise by providing a series of spring-controlled dogs or claws which may be depressed to engage the ground surface, an adjustable wheel being provided to depress the dogs to a position beyond the circumference of the tire at the under side of the wheel as the latter rotates.

A Novel Wheel Rim.—Victor Lindholm of Hoquiam, Wash., has patented, No. 1,063,888, a wheel rim, one flange of which has an entrance opening, which can be closed by suitable means provided for that purpose. The tire is composed of a series of sections of wire rope inclosed in a rubber casing and bent longitudinally to conform with a conventional tire with the sections held at their ends in tubes which can be slipped through the lateral opening in the rim flange and then adjusted to suitable position, so that the tire will be composed of a number of these sections resting side by side and extending thus entirely around the rim of the wheel.

Car Runs 83.5 Miles on a Gallon.—Exceeding by many miles any previous world's record for mileage on a given quantity of fuel, a Franklin car, in an official test by the Automobile Club of America, recently ran 83.5 miles on a single gallon of gasoline over the roads of Long Island. The highest previous official record was 46.1 miles, made in 1909, also with a Franklin car. The new record was made with a specially constructed car having a stock motor of 18 horse-power, and a rear axle geared 1½ to 1. Since there was no differential which would fit this special bevel gear the car was driven only through one rear wheel. A Newcomb carbureter was installed on the engine. The oil consumption was so small as to be almost negligible, less than ⅛ of a pint being used during the entire run. At this rate a car would make 5,344 miles on a gallon of lubricating oil. The gasoline used had a specific gravity of 0.732 (or 61.8 deg. Bé. at 60 deg. Fahr.), no adulterant of any kind being used.

Relation of Brakes to Car Weight.—In the May 10th issue of the SCIENTIFIC AMERICAN there was published an item on Brake Capacity and Efficiency. The statement, attributed to Prof. C. B. Veal, of Purdue University, that brakes should be designed with one square inch of braking surface to every ten pounds of car weight, should have been given as one square inch to every fifteen pounds of gross car weight. In pointing out the error in this item Prof. Veal informs us that the coefficient of friction will be determined by the kind of material and finish employed in the brake drum and in the lining: and that this coefficient, the heat and wear resisting qualities, design of the brake, as well as the relation of the peripheral velocity of the road wheel to that of the brake drum, all have a direct bearing upon the amount of brake surface required. In general practice the relation of wheel diameter to brake drum diameter varies between 2¼ to 1 and 2¾ to 1 for pleasure cars, while for a loaded truck this ratio may run as low as 1.8 to 1. In the latter case the amount of brake surface per unit of weight may be reduced by one half the above value for pleasure cars. In both pleasure and commercial vehicles, if transmission or jack-shaft brakes are provided instead of the rear hub type, the amount of brake surface required will be decreased approximately in proportion to the increase in brake-drum velocity, since owing to the mechanical advantage gained in the gear reduction the same retarding effect can be secured with less braking effect.

An Integrating Opacimeter for Stellar Photography

By Jacques Boyer

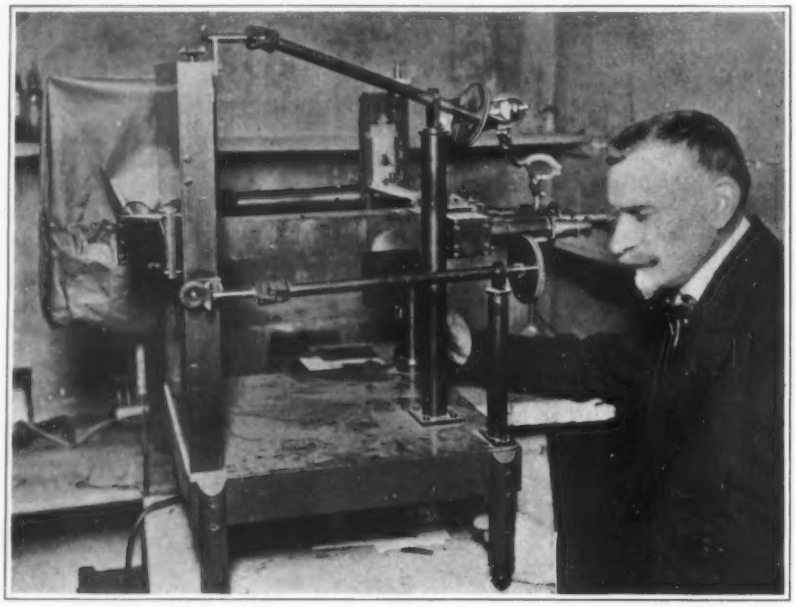
M. JULES BAILLAUD has presented before the Academy of Sciences of Paris an opacimeter which will render valuable service to astronomers in the study of stellar photographs. The opacimeter which is now most extensively employed in astronomical observations is Hartmann's microphotometer, which, though excellent in its way, does not appear to satisfy all demands completely. This instrument produces, by means of microscope objectives of high magnifying power, real images of the photographic plate and of a movable photographic standard scale, increasing in density from one end to the other. The grain of the silver deposit is seen in both images, and the measurement consists practically in comparing the distinction of the grain in the two photographs, and finding a part of the scale comparable with the star image. Hence the scale must have the same grain as the star plate, and it must therefore be changed for each new emulsion and developer.

Another requirement, still more important and more difficult to realize, is that the star images must be perfectly homogeneous. This is never the case with extra-focal images; those formed by modern instruments do not show visible wings, but they are more transparent at the center than at the edge. Schwarzchild has overcome the difficulty with his "Schraffiercassette," but this is an extremely complicated apparatus, and it cannot be used in some kinds of astronomical work. For example, it would prevent the simultaneous employment of a photographic equatorial and a telescope of short focus.

It seems preferable to adopt an optical system analogous to that of the Gouy spectrophotometer. This has been done in the Baillaud opacimeter, a plan of which is shown in the accompanying diagram.

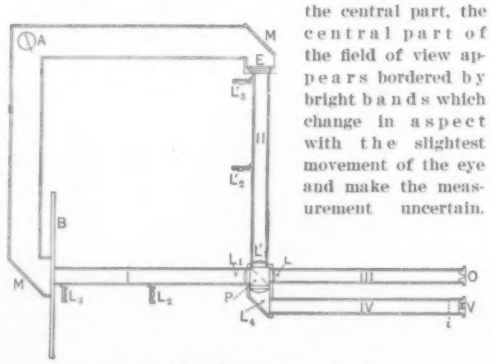
In Baillaud's instrument, as in Hartmann's, the star plate B is compared with the scale E with the aid of two telescopes, I and II, and a Lummer and Brodhun double prism P, which is cemented together and forms a cube. The central part of the diagonal surface is clear, and transmits light from the telescope I, whose outer parts are silvered, and reflects light from the telescope II. In the present instrument, however, the two objectives L L' are focused on the plate B and the scale E, so that the prisms are traversed by pencils of parallel rays. A lens L receives both pencils, and forms superposed images of the plate and the scale in the plane of the eyehole O. The eye placed behind this aperture receives the whole of both luminous pencils and, looking at the lens L, compares the illumination of the central spot, produced by the rays coming from the star plate, with the illumination of the surrounding annular zone, produced by the rays coming from the standard scale, and reflected on the double prism.

The region of the plate under observation is the area whose image is bounded by the eyehole. This area is inversely proportional to the magnifying power of the optical system $L\,L_1$, which, in turn, is proportional to the ratio of the focal lengths of the two lenses. Each of the telescopes I and II, which are exactly alike, is provided with three objectives, L_1, L_2, L_3, and L_1', L_2', L_3', respectively. The advantages possessed by the new Baillaud opacimeter (a duplicate of which has been installed in the observatory of Bucharest, Roumania) are very evident. In the first place, it is possible to measure with this instrument the aggregate transparency of any part of a plate lacking in uniformity. Only one standard scale is required and the comparison is made between the brightness of two adjacent surfaces.



Baillaud's integrating opacimeter, employed in the study of stellar photographs in the Observatory of Paris.

When the stellar image is very heterogeneous, especially when the edge, bounded by the eyehole, is much lighter than the central part, the central part of the field of view appears bordered by bright bands which change in aspect with the slightest movement of the eye and make the measurement uncertain.



Plan of Baillaud's opacimeter.

This defect is remedied by the addition of a small view telescope IV focused upon the aperture in the silvered surface of the double prism, and provided with a diaphragm (which serves the same purpose as the eyehole), and an eyepiece V, which forms an image of this diaphragm on the pupil of the observer's eye. The central aperture of the silvered surface still appears to be bordered by a bright band, but this is fixed in position and brightness, and does not diminish the accuracy of the settings, provided that the measures are made by contrasting the brightness of the two surfaces separated by the bright ring, rather than by trying to make the line of demarkation between them disappear (as is usually done when the surfaces appear of uniform brightness).

When the instrument is used in this manner, it is truly an integrating opacimeter, which gives the total illumination produced by the rays coming from every point of the stellar image.

Cathode Rays from Incandescent Lamps

By Our Berlin Correspondent

WHEN a carbon filament lamp is operated at a tension above normal (for instance, a 50-volt lamp at 75 volts) a bluish glow is sometimes seen to fill the whole bulb, which, in the spectroscope, shows the lines of mercury. This glow, on account of the gas given out by the bulb or the filament, will disappear again after two to three minutes. On approaching a horseshoe magnet it is concentrated into a single tube of force passing through the incandescent filament.

These phenomena, which have been recently investigated by Prof. L. Houllevigue of Marseilles University, are evidently due to the electrons given out from the carbon filaments, and which by striking the residual mercury vapor in the bulb will render this luminous.

When glass reservoirs of different forms are cemented to the bulb and the apparatus is connected with a Gaede air pump, the glow is seen to penetrate into the reservoir to a distance that increases with the vacuum and the heat of the filament. If in the apparatus are inserted electrodes kept at different tension, the glow is seen to behave like a gaseous mass negatively charged in bulk, that is to say, it is attracted by positive and repelled by negative charges. The effect of a magnetic field is not very marked; while the glow is seen to contract, no lateral deflection, in accordance with the laws of electro-magnetism, is observed.

These phenomena seem to suggest that the glow is due to electrons sent out from the negative end of the filament, which after traversing complicated paths in the interior of the reservoir, return to the positive end.

Interesting phenomena are also obtained with an arrangement similar to that used for the production of canal rays (Fig. 2). An incandescent bulb A is connected with the reservoir B by a tube T which contains either a platinum coil or a hollow platinum cylinder raised to a higher potential than the filament; this is how an electrical "acceleration" field, adjustable at will, is established between T and the filament. Under these circumstances the same diffuse luminescence as before is obtained in the reservoir B, provided the vacuum be sufficient, except that it contains a considerably brighter beam of rays with accurately defined outlines. The same phenomenon is observed with a lamp worked at normal tension, but it is altered distinctly by any slight variation in the operation of the lamp.

A characteristic feature of the rays is their extraordinary sensitiveness to the action of magnets, even the terrestrial field being sufficient to produce an appreciable deflection.

From the experiments made with these rays it is concluded that they are real cathode rays of comparatively low speed, say about 5,000 kilometers per second.

Fig. 1.—Incandescent lamp giving out slow cathode rays.

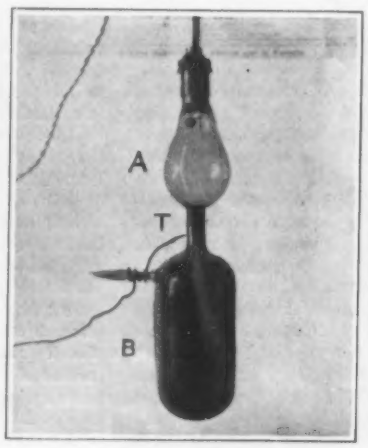


Fig. 2.—An arrangement similar to that used for production of canal rays.

Fig. 3.—Ordinary cathode rays undergoing no reflection.

Fig. 4.—Cathode rays reflected from the side of the vessel.

New Kerosene Vaporizer Demonstrated

WITH the increasing cost of gasoline as a fuel for automobile motors, engineers have been striving for many months to produce a cheaper fuel or to bring out a carbureter or vaporizer that will enable the motor to operate on one or more of the existing heavier oils. It would seem that much has already been accomplished along this line, since the Standard Oil Company recently announced that it had brought out a new fuel called "motor spirit," which takes the place of gasoline, and in some instances gives even more power than the same quantity of gasoline.

On the other hand, great advancement has taken place in the development of apparatus to increase the power derived from existing fuels such as kerosene, alcohol, distillates and heavy oils. This was clearly and convincingly demonstrated in a recent test in New York city of the G. C. vaporizer which has been introduced into this country by an English firm.

This vaporizer takes the place of the muffler on the vehicle and resembles it in appearance. It is constructed in such a manner that the fuel, in being drawn through it, is subjected to the heat of cast iron accumulators which are kept at a high temperature by the exhaust gases. Thus the fuel is vaporized before it reaches the carbureter and is in proper condition to be mixed with outside air to form the explosive mixture.

In the test mentioned several different fuels were tried. These included gasoline, kerosene, denatured alcohol, heavy oil distillate and a refined pine wood distillate having the nature of turpentine. With the engine running at 1,500 revolutions per minute, 66 horsepower was obtained with gasoline when operating only with the carbureter. With the vaporizer switched in between the fuel supply and the carbureter, the horsepower derived from gasoline, at the same motor speed, was 67; with kerosene, 67; with the turpentine spirit, 67.3; with distillate, 63.5; and with alcohol, 61. The consumption of gasoline with the carbureter was 0.8 of a pound per horse-power per hour, while this figure was reduced to 0.7 with the introduction of the vaporizer, representing a saving of 12½ per cent.

The following table shows the exhaust gas analysis at two different speeds of the motor, first with the carbureter and then with the vaporizer:

EXHAUST GAS ANALYSIS.

	With carbureter		With vaporizer	
Speed	1,200	1,600	1,200	1,600
CO_2	9.6%	7.4%	12.0%	10.2%
CO	1.5%	3.2%	0.6%	2.8%
O	2.2%	4.3%	0.4%	0.8%

The temperature at which the fuel is mixed with air in the vaporizer varies between 550 and 750 deg. Fahr. A certain amount of air passes into the vaporizer and is raised to this temperature, although the mixture is reduced to a temperature of about 122 deg. Fahr. on being mixed with additional air in the carbureter.

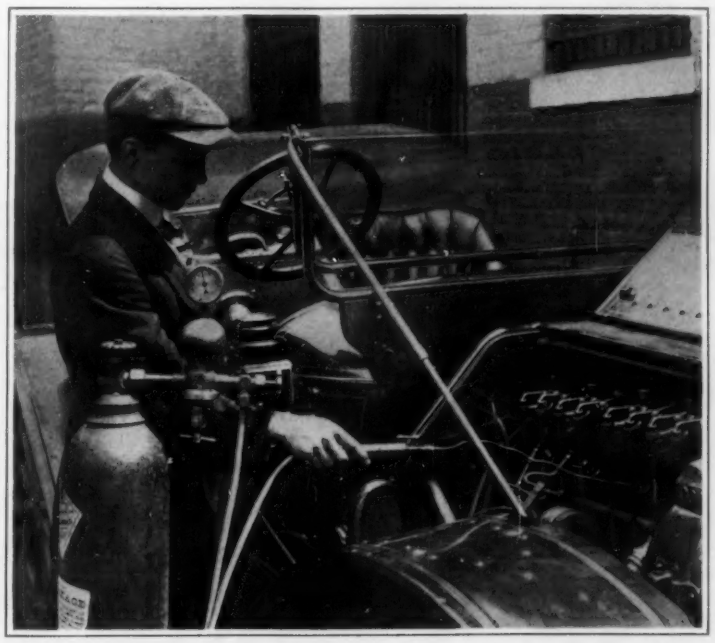
Removing Carbon Deposit with Oxygen

CARBON deposit in the cylinders and valves of internal combustion engines has always been one of the great disadvantages of this class of motive power. This is emphasized more strongly in the automobile motor than in any other type of engine on account of the frequency with which it is found necessary to take down the cylinders and remove the valves for the purpose of getting rid of the carbon deposit.

However, the motorist may now rejoice, for a new quick and easy method has been found by means of which the worst carbon deposit may be cleaned out of the engine in a few minutes without the necessity of taking down the motor or removing the valves. The device is known as the Dy-Karbo, and is shown in operation in the accompanying illustration.

The outfit consists of a tank of oxygen gas, a sensitive valve and regulator, a reservoir and gage, several feet of pressure hose and a torch. On the end of the torch is a flexible copper tube of small bore and about 18 inches long. With this outfit it is necessary only to remove a valve cap or sometimes only a spark plug, so that the small copper nozzle may be inserted in the cylinder. The tube is very soft and flexible and can be bent so as to reach all parts of the cylinder and valve where carbon is likely to be found.

When the nozzle is inserted in the spark plug hole or valve cap opening the carbon is ignited by means of a taper as soon as the gas is turned on. Since oxygen attacks carbon very readily, the deposit is burned away from the surface of the iron at a very rapid rate. As soon as all carbon has been consumed the burning automatically ceases, since the gas has no effect the instant the cylinders and valves are clean. The process affects only the carbon and does not attack the metal of the cylinders. In a cylinder where the carbon deposit is extremely heavy, only a few minutes are required to burn all of the deposit away.

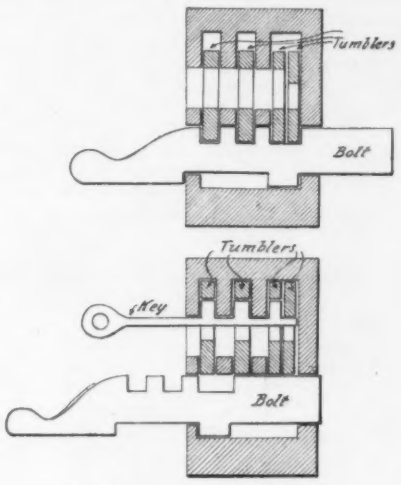


Burning out carbon deposits with oxygen.

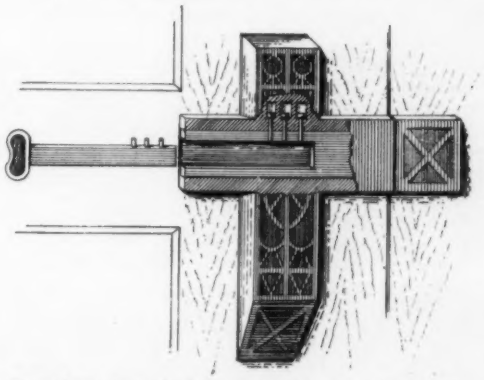
The Prototype of the Yale Lock

By Walter Schumann

NOT long since I had opportunity to discover that the principle of the Yale lock, so well known to Americans, is not the product of the fertile brain of an American inventive genius, as I had hitherto always surmised, but that it was known to ancient Romans, and was in use by them, as early as the beginning of the Christian era, if not before.



A "Yale" lock of Roman times.



Egyptian pin-type lock invented over four thousand years ago.

Far up among the Taunus Hills, about half an hour's trolley ride from the well-known German spa of Homburg, the erstwhile favorite watering place of the late King Edward VII. of England, on a commanding hilltop, is an old Roman outpost that was destroyed by the barbarians. Of late years, however, and at the instance of archæologists, the site of this outpost has been thoroughly investigated, the ruins laid bare, and on the original foundations the walls of the outworks as well as the inner buildings have been reconstructed according to Roman tradition.

Among the many articles of use and ornament discovered in the course of the excavations, all of which are exhibited in one of the reconstructed buildings, the thing that interested me most was the style of lock that had been in use by these Romans. It is built precisely on the principles of the modern Yale cylinder lock with its tumblers and serrated key. I procured a replica of one of these locks (there were a number of them, each with a different combination of tumblers) and I herewith submit a drawing of it.

One of the drawings shows the lock closed and the key withdrawn. It will be noticed that the four tumblers have dropped into the serrations of the bolt and securely hold it in place, preventing it from being slipped back. The other drawing shows the key inserted in the slot, the tumblers raised, and the bolt slipped back.

A glance is sufficient to note that the lock is built on the same principle as the modern Yale cylinder lock; the only difference being that in the Roman lock the key, after being inserted in the slot, is lifted upward in order to raise the tumblers, and that the bolt is then slipped back with the other hand; whereas, in the Yale lock the key is turned and not only lifts the tumblers, but at the same time releases the bolt.

It is perfectly evident, however, that the principle is the same in both locks, and little do we think, as we slip the little serrated key into the lock when we enter our home, that the ancient Romans unbolted the doors to their houses in practically the same way.

[A much older lock employing the "Yale" principle was described in the SCIENTIFIC AMERICAN of September 2nd, 1899. The lock, as shown in the accompanying drawing, is of the pin type and was used some 4,000 years ago in Egypt. Similar locks are still to be seen in some of the older streets of Cairo.—EDITOR.]

The Inventors' Guild and the Oldfield Bill

AT a meeting of the Inventors' Guild, held in New York city, on May 28th, resolutions were adopted in which the Oldfield bill was strongly condemned. In these resolutions an invitation is extended to the Chambers of Commerce in the principal cities of the United States and similar representative organizations to aid the Guild in its efforts to secure the appointment of a special commission, which will make a thorough and careful study of the American patent situation and then recommend to Congress such changes as may appear expedient. It will be remembered that in 1911, the Guild petitioned President Taft to have such a commission appointed. President Taft responded by sending a special message to Congress on the patent system in which the recommendations of the Guild were indorsed. Congress did absolutely nothing in the matter.

There is reason to believe that President Wilson is not indifferent to the faults of our patent system. In his "New Freedom," he comments upon the difficulty many inventors now experience in "reaping the full fruits of their ingenuity and industry," and he states that "one of the reforms waiting to be undertaken is a revision of our patent laws."

But whether or not the President will of his own initiative urge upon Congress the necessity of patent reform, there can be no doubt that if the present plan of the Inventors' Guild is carried out, Congress cannot remain indifferent. The Chambers of Commerce of our large American cities, representing as they do the industrial interests of thousands, dependent upon absolute justice and fairness in the granting and upholding of patent rights, cannot be ignored. So far as we are aware, the Cleveland Chamber of Commerce is the only body of this character which has considered the patent situation at all. Indeed, its admirable, critical study of the Oldfield bill, and its report on the patent system of the United States, antedated and probably inspired the present resolutions of the Inventors' Guild. If the example of the Cleveland Chamber of Commerce were followed, who can doubt that Congress would be induced to appoint a commission which would thoroughly study the patent system and which would result in the enactment of the kind of legislation that would meet with the approval of inventors, manufacturers and the general public.

For years business men have pointed out the need of a new Patent Office building, a simpler and more efficient system of Patent Office administration, and readier means of bringing infringers of patent to book, but Congress does nothing.

Comparison of French and German Strength in Dirigible Airships

Why Germany is the Leading Air Power

IN a recent number of *La Nature*, there appears a critical estimate of the relative air strength of Germany and France. Inasmuch as these two powers have been keen rivals in attaining what may be called a supremacy of the air, an abstract of our French contemporary's article will doubtless prove of interest to our readers.

As regards the French dirigibles,[1] the three most recent aerial cruisers, as well as the largest (9,000 cubic meters), fastest (55 kilometers per hour), and the best equipped, are the "Adjudant-Vincenot," located at Toul; the "Adjudant-Reau," at Verdun; and the "Dupuy-de-Lome," at Maubeuge. To these should be added the "Fleurus," which exceeds them in speed (58 kilometers an hour), but has not as great a gas capacity (6,500 cubic meters). On the first three engines of 200 to 250 horse-power are installed; whereas but a single engine of but 160 horse-power drives the "Fleurus." The diameters, however, are about the same, as shown in Table I.

The table lists the French dirigibles which have actually been built, including privately owned craft, which can be commandeered in time of war. The names of these are given in italics.

Most of the French dirigibles are of the flexible or non-rigid type (S.). Between 1908 and 1911 France built four semi-rigids (S. R.). The recently completed "Spiess," a wood-frame dirigible, marks the entrance of France into the field of rigid dirigibles (R.) hitherto dominated by Germany. On the other hand, it should be noted that one of the flexible types, the trilobed type invented by the Spanish engineer, Torres Quevedo, and built in France by the Astra Company, presents advantages analogous to those of the rigids, because of the means adopted to preserve the shape of the envelope under varying conditions of temperature and gas pressure.

Such as it is, our French contemporary admits that the French fleet of aerial cruisers is inferior in number, gas capacity, speed, and radius of action to the German. The difference is even greater than shown in Table I, for *La Nature* has tabulated only the best French airships, vessels which would be immediately available in case of war. Most of the others are either being repaired or remodeled. For example, the new "Spiess" rigid will be available only after a long period of testing.

By the end of 1913 the French military aeronautic authorities will surely have put in service seven large military dirigibles of 20,000 cubic meters gas capacity and a speed of 75 kilometers an hour. The four large airship manufacturers (Bayard-Clement, Astra, Zodiac, and Lebaudy) expect to construct four large privately-owned cruisers as well as four other dirigibles of the "Fleurus" type, which will be built by the first three of the above-mentioned firms. Hence, taking account of delays, etc., by the end of this year France may have a dozen large dirigibles actually in service, though these will be inferior to the large German cruisers.

Germany's dirigible strength is shown in Table II. What strikes us at once is the large number of rigid cruisers and their gas capacity, speed, and radius of action. We may add that the available load they are capable of carrying surpasses five tons for the great Zeppelins ("Victoria-Luise," "Hansa," "Z3") and six tons for the latest marine dirigible.

In the table the Zeppelins are indicated by the letter Z (or L for the marine dirigible), the Parsevals by P or PL, the Ruthenbergs by R. *La Nature* omits the three Gross military semi-rigids formerly designated by the letter M. One of these, after being repaired, will be stationed at Metz. Neither has *La Nature* included "Z4," which figured in the Luneville incident. "PL6" and "PL9" are out of service.

This table does not pretend to be complete, nor even to be very exact, since changes in aeronautic organization, as well as in the stations of airships, are frequent and secret. Thus the names of the stations must be considered merely as an indication. "Z3," for instance, indicated as attached to Berlin, is really said to be destined for Metz. Likewise it is impossible to know from day to day which craft are in commission. But the list reproduced from *La Nature* suffices to show that Germany does not possess forty Zeppelins, as the European press has frequently asserted.

Though only one Suchard is given in the table, there is a second Suchard, which is more celebrated, since it is the dirigible which, under the command of Capt. Bruecker, was intended to voyage from Las Palmas (Canary Islands) to the West Indies. As for the Parseval type, its gas capacity is 12,300 cubic meters with a car 10 meters long and a 200 horse-power engine.

While it is impossible to state definitely to which airship harbors German dirigibles are attached, it is certain that they can be housed in eighteen sheds of the fixed or turntable type. These sheds are situated at Berlin, Biesdorf, Potsdam, Königsberg, Posen, Kiel, Hamburg, Düsseldorf, Leichlingen, Cologne, Metz, Frankfurt, Mannheim, Baden, Strassburg, Gotha, and Friedrichshafen.

It is perhaps the privately-owned dirigibles ("Victoria-Luise" and "Hansa") which are the most dangerous. They are or will be completely armed. The marine "L1" even carries a machine gun. It is to be particularly noted that the Germans have seriously studied not only the character of weapons, but also methods of firing. The crews of dirigibles are trained in target practice to hit objects on the ground.

All the dirigibles except the Parsevals are equipped to send or receive wireless messages. In the five factories (at Munich, Friedrichshafen, Mannheim, Berlin, and Bitterfeld) new units are at present in course of construction, of which six are privately-owned dirigibles (one Zeppelin and five Parsevals).

By the end of 1913, then, Germany will have a score of great cruisers actually in commission. Among those now building *La Nature* mentions only two Zeppelins as against four Schuette-Lanzes, which have a wooden framework, and a gas capacity of 24,000 cubic meters. Two of these are intended for army and two for naval use. A Parseval is also ordered for the navy.

(*Concluded on page 133.*)

TABLE I.—FRENCH DIRIGIBLES.

Station.	Name of Dirigible.	Date and Type.	Capacity in Cubic Meters.	Length, Meters.	Diameter, Meters.	H. P.	Speed (Kilometers per Hour).
Toul	*Adjudant-Vincenot*	1911S.	9,000	89	12.80	200	55
Verdun	*Adjudant-Reau*	1911S.	8,950	87	14.02	240	55
Maubeuge	*Dupuy-de-Lôme*	1912S.	9,000	89	12.80	250	55
	Selle de Beauchamp	1911S.R.	8,000	89	14.60	150	50
Saint-Cyr	*Fleurus*	1912S.	6,500	77	12.50	160	58
	Le Temps	1911S.	2,500	50	9.50	70	50
	Zodiac-3	1909S.	1,430	42	8.20	40	45
Epinal	Capitaine-Ferber	1911S.	6,000	76	13	140	55
	Commandant-Coutelle	1912S.	9,000	....	....	380	....
Châlons	Capitaine-Marchal	1911S.R.	7,500	84.50	13	150	47
Issy	Lieutenant-Chauré	1911S.	8,950	87	14	240	55
	Transaérien	1912S.	9,000	76	14.50	300	55
	Conte	1912S.	6,600	65	12	150	50
	Colonel-Renard	1910S.	4,200	66	11	100	50
	Astra-Torrès	1911S.	1,600	47.50	8	55	50
Meudon	Lebaudy-4	1911S.R.	3,300	61	10.50	70	45
	Liberté	1909S.R.	4,800	71.50	13	120	....
Lucerne	*Ville-de-Lucerne*	1909S.	4,450	60	13	100	44
	Spiess	1912R.	11,500	....	13	400	?

TABLE II.—GERMAN DIRIGIBLES.

Metz	Z-1	1912R.	12,000	126	12	230	58
	P-1	1908R.	4,000	60	10.50	85	51.5
Hamburg	L-1	1912R.	22,000	160	15	510	83.5
	Victoria-Luise	1912R.	18,700	147.50	14	450	80
Bitterfeld	*PL-1*	1908S.	3,200	60	8.50	85	45
	PL-10	1912S.	1,800	45	9	100	50
	Clouth	1909S.	1,840	42	9.50	50	32
Berlin	Z-3	1912R.	20,000	149	14	510	80
	P-3	1911S.	10,000	86	15	400	67.5
	R-2	1910S.R.	1,700	46	7.30	75	38.5
	R-3	1912S.R.	3,960	65	11	120	51.5
	PL-6	1910S.	7,500	68	15	220	51.5
	PL-9	1911S.	1,800	45	9	50	46.5
	PL-12	1912S.	8,050	70	15	220	60
	Suchard	1911S.	11,700	76	16.50	220	45
Potsdam	*Hansa*	1912R.	18,700	147.50	14	450	80
Cologne	Z-2	1911R.	17,250	140	14	450	77
	P-2	1912S.	8,050	80	14	300	63
Koenigsberg	P-4	1912S.	10,000	86	15	400	68
Biesdorf (near Berlin)	S.-S. (Siemens-Schuckert)	1911S.	15,000	....	14	650	74

Comparison of French and German dirigibles and the location of the principal German air harbors.

[1] Military dirigibles of over 8,000 cubic meters gas capacity are called *cruisers*, those of 5,000 to 8,000 *scouts*, and the smallest, *vedettes*.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Extending the Law of Unfair Competition

To the Editor of the SCIENTIFIC AMERICAN:

The "Sanatogen" decision is in keeping with public sentiment on the matter of the right of a manufacturer to fix the retail selling price on patented articles, and of recent years court decisions are apparently greatly influenced by public demand. There should be a Federal law governing unfair competition, so as to enable all manufacturers of any advertised or trade-marked article, patented or unpatented, to maintain a uniform retail price thereon. Where price cutting is permitted, the tendency is to place the small retailer in a position where it is impossible for him to compete with his larger competitors.

We assure you of the approval of this company with the efforts of the SCIENTIFIC AMERICAN to further the cause of merchandising in a manner profitable to all dealers, manufacturers, and the general public.

AMERICAN THERMOS BOTTLE COMPANY,
New York city. WILLIAM B. WALKER, President.

Cast Steel Ties and Screw Spikes

To the Editor of the SCIENTIFIC AMERICAN:

A most interesting article appeared in the issue of June 7th, 1913, on "Screw Spikes;" you also speak of the antiquated practice of American railroad builders; also of the tie plates cutting into the surface of the wooden ties. I inclose herewith a cut of a screw spike, which I have found very useful in connection with cast steel ties which were manufactured several years ago and placed into the tracks of the Lehigh and New England Railroad, where they have been in service since, also an insulated cast steel tie which is in service on the Lehigh Valley Railroad.

These ties combine tie and tie plate, are elastic, light, strong, and would wear indefinitely. The screw spikes are fastened into blocks or some other substance used for that purpose, for which receptacles have been provided at each end of the tie. The blocks or other material can be replaced without moving the tie, so that neither ballast need be removed nor service of the track impaired while repairs are being made.

Combined tie-plate and tie and one of the screw spikes.

On an electric road they are a most valuable asset, since repairs on city streets would be reduced to the smallest minimum. The cast steel tie is preferable to any rolled device, since the latter require bolts and clips, which are a continual expense and dangerous, while screw spikes are used with cast steel ties, thereby insuring safety.

The accompanying photographs show two of the ties in position, also a screw spike.

Bethlehem, Pa. MILTON M. MITMAN.

How the Consumer is Affected

To the Editor of the SCIENTIFIC AMERICAN:

Price cutting does not lower the cost to the consumer. It can only lower the quality to the consumer. Price cutting, in encouraging and necessitating the lowering of quality, works injury to the consumer, distributor and producer.

Modern competition comprehends price, quality and service. If competition must depend on price alone, both quality and service must suffer. Advertised trade-marked goods are sold at the least expense to the consumer because advertising is the most economical form of salesmanship when properly performed. If the manufacturer cannot legally fix his own selling price, he has no foundation upon which to build his quality and his service to the consumer.

Everything is made or done with the consumer in view. The consumer benefits or suffers in ratio to the ability and prosperity of the various distributors and producers.

The producer and distributor must be paid for their service to the consumer just as the consumer is paid for the service he renders in his particular line of endeavor. Therefore, the price of every article must include a profit to pay the producer and distributor for their work.

Under present-day competition, the price of an article must be reasonable. If this price is not reasonable and if it includes any waste or excessive profits, that article cannot long endure. Some unselfish manufacturer, having an article of equal quality, will sell his goods at a legitimate price that includes no excesses, and, therefore, will secure the business that formerly went to the other manufacturer. Thus, the very fact that any article can remain on the market at a fixed price for any length of time is proof that it is good value.

Granted, then, that the prices of such articles include only a fair profit for the distributor and producer. If such a profit is cut, it must follow that either the producer or distributor is not being paid for his work.

If continued price cutting so lowers the prestige of this article that the previous fixed price can no longer be secured, the cut price will soon become regarded as its fixed price and the producer and distributor cannot figure on getting any higher price for the goods.

It is, however, obvious that the distributor and producer must be paid. If, therefore, they can only depend on a lower price, they must lower the quality of the goods, so that their profit may be secured even at the reduced price. When such a cut price is established, the consumer really stands a loss through reduction in quality of the article, which formerly sold at the larger and legitimate price.

Therefore, I believe any legislation aimed toward eliminating this evil is essential to the good of the country. It should be instituted as vigorously as possible. E. A. STUART.

Seattle, Wash.

The Law of Magnetic Communications Between Human Beings

To the Editor of the SCIENTIFIC AMERICAN:

During his lifetime the late Andrew Lang as a member of the Society for Psychical Research collected a great deal of valuable data as to communications received by one person from another separated by vast distances, without the aid of telegraph or telephone.

It is well recognized that evidence of such communications must be well sifted and weighed, because of the tendency to deception and fakery in dealing with such matters; but allowing for a large percentage of fakery in the evidence secured by Mr. Lang, the residue is of such a reliable nature as to make it reasonable to declare that the truth of such communications is well authenticated.

Now, reasoning from analogy, such communications are not any more wonderful than the communications received over the wireless telegraph. In both instances, the force transmitted is the same—magnetic or electric; nervous energy being electrical in its nature, as demonstrated by those who have studied the nervous system; as shown by the effect of the electrical battery on the human system; of the galvanic energy transmitted through the legs of a frog. While we may trace the manifestations both of electrical and nervous energy, the nature of either force is mysterious and defies analysis.

Until Marconi discovered the secret, the law of utilizing electrical vibrations without wires was unknown. His discovery was simple in its nature, as all great discoveries are, i. e., the instrument creating the vibration must be in unison with the instrument receiving it.

With this idea in mind, it will be found that the incidents adduced by Mr. Lang occurred between persons who were strongly bound together in unity of aim and thought at the time; and while he does not impart this detail, they must have been persons of a vigorous nature, capable of storing and generating much magnetic energy.

Now, the law discovered by Mr. Marconi was not applied practically until some time after he had discovered the principle. I contend that with proper experiments, under the guidance of men of scientific attainment, a method will be found by which communication may be effected, at will, at any time, between human beings separated by great distances. The following, I believe, is a crude statement of the law governing such communications:

The person sending the message must be one strongly in unison with the person receiving it; and each human instrument must be a person of a vigorous and magnetic personality.

If this law can be demonstrated in a practical manner, as was Marconi's law, it will be of more importance to human kind than was Kepler's law of planetary motion; because Kepler did not enlarge the usefulness of astronomy by demonstrations of his law, as the epicycle theory of Ptolemy was just as good a working theory as Kepler's; but the practical demonstration of this law of magnetic communication will be of real use to humanity. Two adequate magnetic personalities communicating between New York and Philadelphia, or even Chicago and Milwaukee, would produce as much of a sensation in the scientific world as did the first successful communications over the wireless telegraph. SCUDDAY RICHARDSON.

Houston, Texas.

[The analogy between wireless communication and telepathy is not altogether complete. The wireless telegraph does not transmit thought, but simply signals which can be translated into an intelligible communication. Telepathy, on the other hand, deals with the direct communication of thought. Even the wireless telephone is not a perfect analogue to telepathy; for spoken words are but the equivalent of Morse signals. The brain must first learn that a certain combination of letters and sounds such as "water" means a definite thing. In telepathy brain responds directly to brain without the need of interpreting signals or spoken sounds.

We cannot agree with our correspondent that strong personalities are required to conduct telepathic communication. Instances enough are to be found in the proceedings of the Psychical Research Societies of America and England as well as in many books which would seem to indicate that personality, in the sense in which our correspondent employs that word, has very little to do with psychic phenomena. Indeed, some psychical investigators even hold that we are all possessed of psychic powers, but that many of us have not learned the knack of using them. —EDITOR.]

Isolation of the Leprosy Bacillus

To the Editor of the SCIENTIFIC AMERICAN:

In view of your editorial on "Research on Leprosy," appearing in the SCIENTIFIC AMERICAN of June 14th, 1913, there is inclosed herewith a copy of Public Health Bulletin No. 47, which contains an article on "The Artificial Cultivation of the Bacillus of Leprosy." On examination of this article, it will be observed that Moses T. Clegg, now of the Leprosy Investigation Station conducted by the Public Health Service, succeeded in growing the leprosy bacillus in 1909, and isolated it in pure culture during the same year. J. W. KERR, Assistant Surgeon General.

Treasury Department, Bureau of the Public Health Service, Washington, D. C.

The Track Spike Problem

To the Editor of the SCIENTIFIC AMERICAN:

It is with great interest that I have read the articles relative to spikes for railway use. In your issue of July 5th I note a new idea, namely, that of the barbed spike. It has occurred to me that it would be a very difficult, if not impossible, matter to withdraw those barbed spikes from the ties after "the swelling of the wood by the rain."

It does not seem to me that we ought to say aught against the screw spike because train wreckers might unscrew it from the tie; could not those train wreckers, with more ease and success, use some powerful explosive?

"What goes up must come down," is an old saying. We can revise that to fit the rail spike and say, "What goes down must come up."

From my experience with the screw spike, I think that it answers the purpose better than any of the others. FRED. M. LASH.

Portland, Ore.

The Japanese Battle-cruiser "Kongo"

The Most Powerful Armored Cruiser Afloat

THREE new battle-cruisers are now being built in Japan—the "Hiyei" at Yokosuka dockyard, the "Haruna" at Kobe, and the "Kirishima" at Nagasaki, while a fourth, the "Kongo," has recently been completed by Messrs. Vickers, Ltd., at Barrow-in-Furness, and will shortly be delivered. The strategical and tactical qualities governing the design of these four battle-cruisers having been enunciated by the Japanese Navy Department from experience gained in the Russo-Japanese war, it was left to this firm to embody the stipulated requirements. The machinery for the first of these battle-cruisers has also been constructed by Messrs. Vickers, and she is now in an advanced stage of construction, having been laid down at Yokosuka dockyard on November 4th, 1911, while the others were laid down in March of the following year. The vessels have the following dimensions: Length, 704 feet; breadth, 92 feet; draft, 27 feet 6 inches; displacement, 27,500 tons; service speed, 28 knots; maximum coal capacity, 4,000 tons; oil fuel capacity, 1,000 tons; shaft horsepower, 70,000; armament, eight 14-inch and sixteen 6-inch guns; torpedoes, six 21-inch submerged.

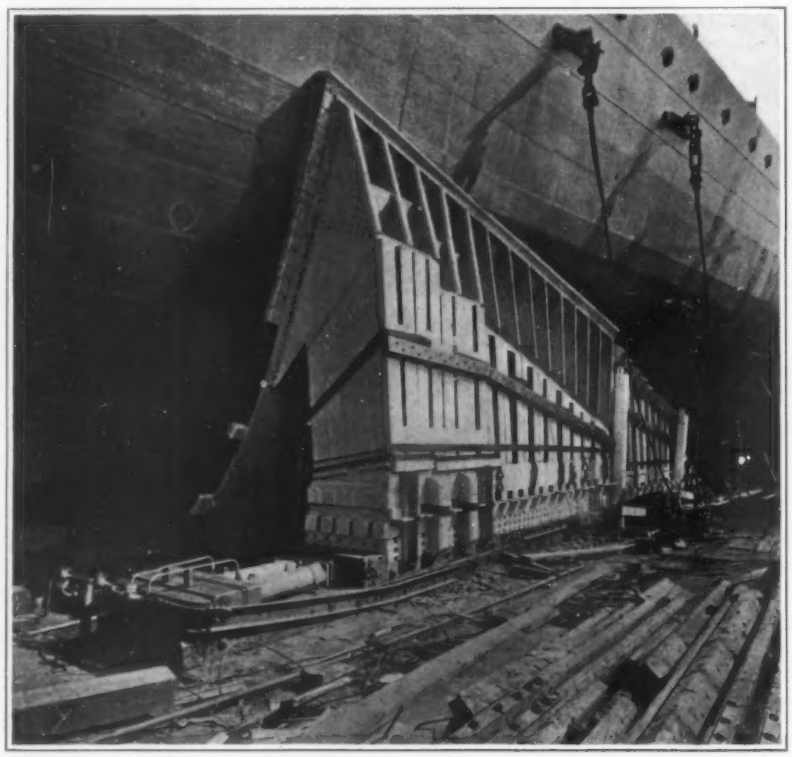
It will, therefore, be gathered that the "Kongo" and her sister ships are practically the same length as the "Princess Royal," but have each 3 feet 6 inches more beam, and 1,000 tons greater displacement, due to the greater fighting qualities laid down by the Japanese authorities. The armament of the Japanese cruisers comprises eight 14-inch guns, as compared with an equal number of 13.5-inch guns in the British ship, an equal number (sixteen) of guns for repelling torpedo attack, but they are of 6-inch bore as compared with 4-inch in the British ship. The "Kongo" has double the number of submerged torpedo tubes fitted in British ships, and as in these they are designed to fire 21-inch Whitehead torpedoes. Generally the broadside armor corresponds to that in the "Princess Royal," but owing to the introduction of armored bulkheads below the waterline, a greater weight has been absorbed for protection in the Japanese ship.

The eight 14-inch guns are mounted in pairs in four barbettes, two of which are located forward and two aft, all on the center line. These barbettes are arranged, and the elevation of the gun is fixed, so that four may fire forward and four aft, while all eight may fire on either broadside. Notwithstanding the very powerful armament provided, the armored protection is most effective, particularly against torpedo attack. The main broadside armor is of special quality steel, and is equal in thickness to that of any battle-cruiser yet designed, and is carried to the height of the boat deck, which is continued on the same level as the forecastle, forming a citadel, into which the 6-inch gun casemates are worked. The main belt extends considerably below the waterline, and under this again there is an auxiliary armor belt extending some distance below the normal armor shelf. There is a special arrangement of armored bulkheads protecting the vital parts of the ship; the magazines, for instance, being completely surrounded with special steel armor. There is an armored deck at the waterline level, and in addition to this there is an armored deck closing in the ship from stem to stern at the level of the top of the side armor.

The water-tube boilers burn oil fuel as well as coal; the turbines are of the combined impulse and reaction type. To insure safety, the boilers are arranged in eight compartments, four on each side of a center line bulkhead which extends throughout their entire length, while the coal bunkers are also disposed to afford protection. Again, the engines—two sets of turbines on four shafts—are arranged in two compartments, with a center line bulkhead between them. The whole of the arrangements preserve the independence of the port and starboard sets of machinery and allow either set to be worked when all parts of the other are disabled. The high-pressure ahead and astern turbines are of the Parsons combined impulse and reaction type.

The full power trial of eight hours' duration was carried out successfully on May 8th, in stormy weather, a gale blowing most of the time. The designed power and the speed of 28 knots were exceeded.

The gun trials took place on May 14th and 15th. The gun-mountings are of the Vickers hydraulic type, but have electric gear for use in the event of the hydraulic system in any way failing. In addition, too, there is a small hydraulic installation for working the guns when they have to be cleaned; but this gear will also serve, instead of manual work, for maneuvering the guns in the event of the main supply of power, either hydraulic or electric, giving out. Another feature of the installation is the application for the first time of the Janney-Williams gear, which proved most reliable and exact in controlling the turret movement, creeping motion or great speed being achieved with equal facility and precision. The most crucial test was the firing of the whole of the 14-inch guns and of all of the 6-inch guns on the starboard beam, making sixteen guns in all. The firing was from the conning-tower and was absolutely instantaneous. It was remarkable that the cascades thrown up by the first contact with the sea of the 100-pound shot from the 6-inch guns were almost simultaneous, suggesting a remarkable uniformity in the trajectory of the guns. The second contact with the water in the case of these shots coincided with the first contact of the 14-inch shot, so that it was not then possible to distinguish between the 100-pound shots and the 1,400-pound shots. The salvo represented a discharge of something over eight tons of metal, with a collective muzzle energy of about 600,000 foot-tons. The effect on the ship was scarcely perceptible, so far as inclination was concerned. No damage was done to the ship's structure, the only damage being to some of the lifeboats, the side planking of which was sprung. The performance was thus in every way an unqualified success, and after the gun trials the ship proceeded to the anchorage at Greenock, whence she left for Barrow-in-Furness on the following day, the torpedo trials being carried out on the way. The "Kongo" is due to leave Barrow for Japan early in August.



The bow cradle, in front of which are the hydraulic rams for starting the ship down the ways.

The Visibility of Submarines

By W. L. Cathcart

THE submarine boat passed long ago from the experimental stage, and is now a definite and important factor in the equipment of the navies of the world. On December 1st, 1912, there were built, building, or authorized for the fleets of England, Germany, the United States, France, Japan, Russia, Italy, and Austria, a total of 341 submarines, having an aggregate displacement of about 133,600 tons. While progress in the effectiveness of these boats has been relatively swift, two comparatively recent improvements have virtually doubled their powers of offense. Owing to the unvarying accuracy of the gyroscopic compass, the location of the ship to be attacked can be observed at a distance of eight miles, and then the boat can be run fully submerged to the exact point where, after a final sight, the torpedo is to be discharged. Again, the effective range of the torpedo itself has been increased to 11,000 yards by the use of turbine engines having superheating apparatus in the pressure current. With such range and accuracy and with its ability to strike below the armor belt at the very vitals of the ship, the deadly power of the submarines, in so far as these qualities are concerned, cannot be questioned.

The development of aviation, however, threatens to affect injuriously the offensive power of the submarine in its most essential characteristic—invisibility. Since these boats are both relatively slow and unarmored, they must be submerged when approaching the ship to be attacked, and hence they must depend on submergence for both their invisibility and their invulnerability. This submergence, however, will apparently no longer save them from view, for, in future naval actions, all large vessels will carry aeroplanes, and the aviator, soaring on high, can readily detect the submarine heading, below the surface of the sea, for its quarry. When Blériot made the first flight across the English Channel, he saw near the town of Deal two torpedo-boat destroyers followed by a long line of submarines, the latter being fully submerged and invisible at sea level, but clearly discernible to him in his monoplane. If he had been an aerial scout in actual service, he could at once have reported the submarines by signals or wireless to the vessels which they were about to attack.

Since then, numerous other aviators have had similar experiences. During the review of the British fleet off Spithead last fall, submarines were thus detected by aerial observers; in maneuvers in Chesapeake Bay, our scouting aeroplanes discovered the under-water craft, without the aid of glasses, although the boats were at a considerable depth below the surface; an Italian aviator in Tripoli saw on the bottom of the bay the charred wreck of the old United States frigate "Philadelphia," which was burned by Decatur in 1803, after her capture by the Algerines; and very recently Lieut. Bakopulos of the Greek navy observed on the reefs called Pharos Bank to the eastward of the island of Lemnos, at a depth of from five to twenty-five meters, the ruins of an ancient city which long ago sank beneath the waves.

In military aviation, it has been found that a trained observer at a height of one mile can distinguish between troops of the various arms on the earth below, so that so far as clear vision of the scene beneath is concerned, man seems now as capable as the soaring eagle or the carrion birds with their far-piercing gaze. Further, the eye at these great heights is able to penetrate the mask which, at the surface, hides the depths of the sea below. There are two reasons for this virtual invisibility of these depths to the unaided eye at sea-level. We see an object by the light radiated from it, and, as the surface of the water reflects much of the light which strikes it, but relatively little penetrates below. Hence, the depths are dark as compared with the sunlit air above. Again, the reflected light at the surface dazzles the eye of the observer and prevents it from receiving such rays as are transmitted from a submerged object. Many deep-sea fishes have globular, protuberant eyes, so shaped as to gather the last ray of dim light about them. To cut out surface reflection, sponge fishers look through the "water telescope," a box without a top and having a glass bottom, which they sink about half way below the surface. The "Dibos water glass," a similar apparatus, is a small tube, six feet long, whose lower end is covered with a glass plate; it is inserted in the water with the observ-

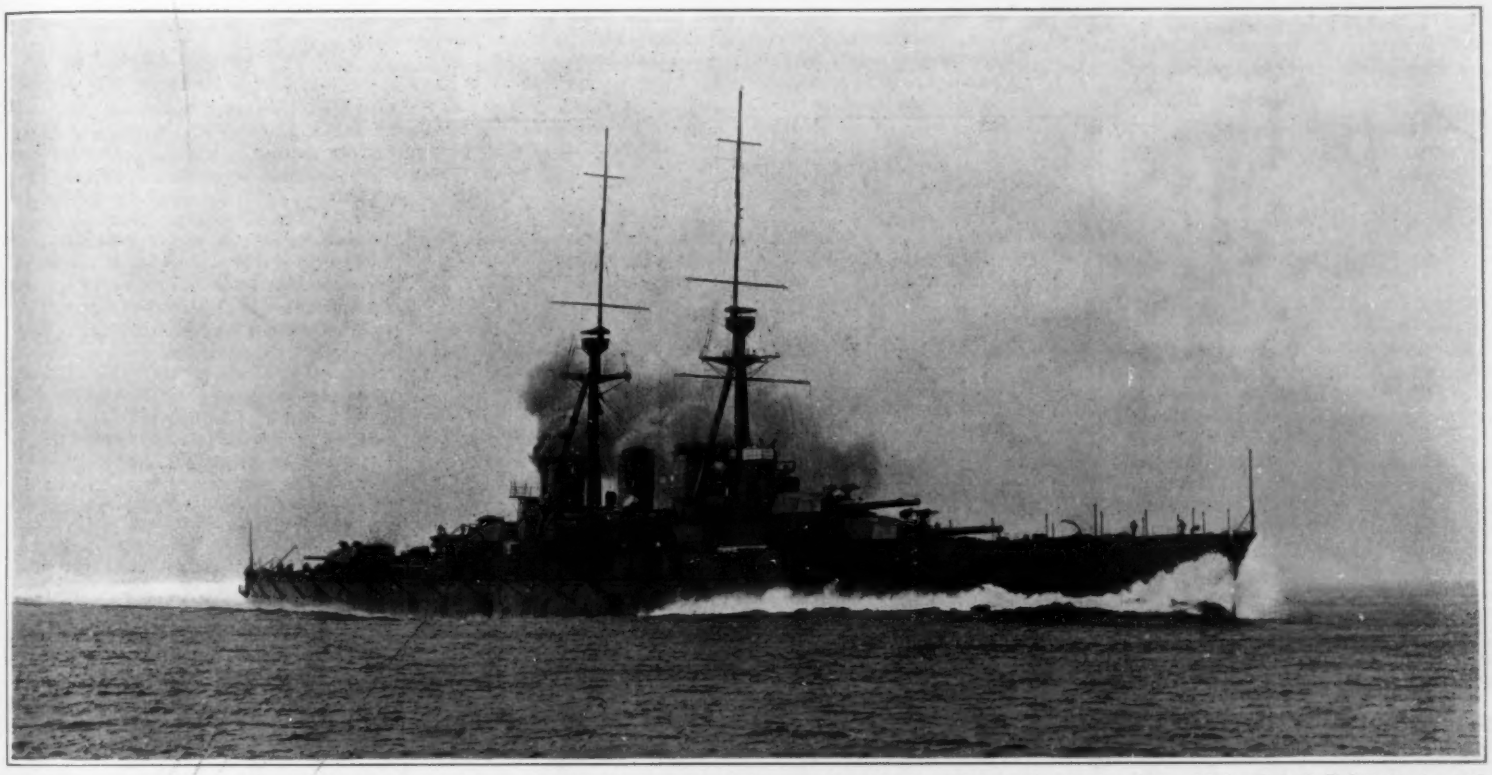
er's eye at the upper end, and is pointed like a telescope at the object to be examined. The glass bottoms of the boats of Nassau and Santa Catalina reveal the wonders of the sea's sunken gardens mainly by cutting off surface reflection, although the transparency of these semi-tropic waters is of much aid.

There are several causes, all involving surface reflection directly or indirectly, which strengthen the power of vision from an aerial height into the sea's depths. For example, as to the amount of light reaching the eye: the intensity of the reflection of light increases with the obliquity of the incident rays, and therefore the reflection of vertical rays is zero. As a consequence, the greater the distance of the observer from the surface, the less the light will be reflected and the larger will be the amount of vertical rays received by the eye. Again, as has been noted, surface reflection dazzles the eye and interferes with the direct rays which otherwise would reach it. By rising to an altitude at which the reflected light is virtually eliminated, as in the case of the aeroplane, the eye receives only the direct rays transmitted from objects beneath the surface.

From these considerations, it seems clear that, in sea water of normal translucency and at its cruising depth in war, the invisibility of the submarine to an aeroplane hovering above it is a thing of the past, except at night and in foggy weather. These conditions have been recognized fully by naval experts. Last September, Capt. Washington I. Chambers, U. S. N., now in charge of naval aviation, in a report on the subject to the Bureau of Navigation, specified, as one of the contemplated uses of aeroplanes in naval warfare, "to locate and destroy submarine mines, submarines, and dirigibles, and to assist in the operations of submarines and torpedo boats." While the visibility of the submarine mine to an aerial observer is another story, we may note in passing that, if Makaroff's flagship, in its sortie from Port Arthur, had been preceded by a scouting aeroplane, the mine which sunk her would have been discovered long before she reached it, and the gallant admiral, his crew of a thousand men, and his great ship would have been saved from the swift destruction which they met.

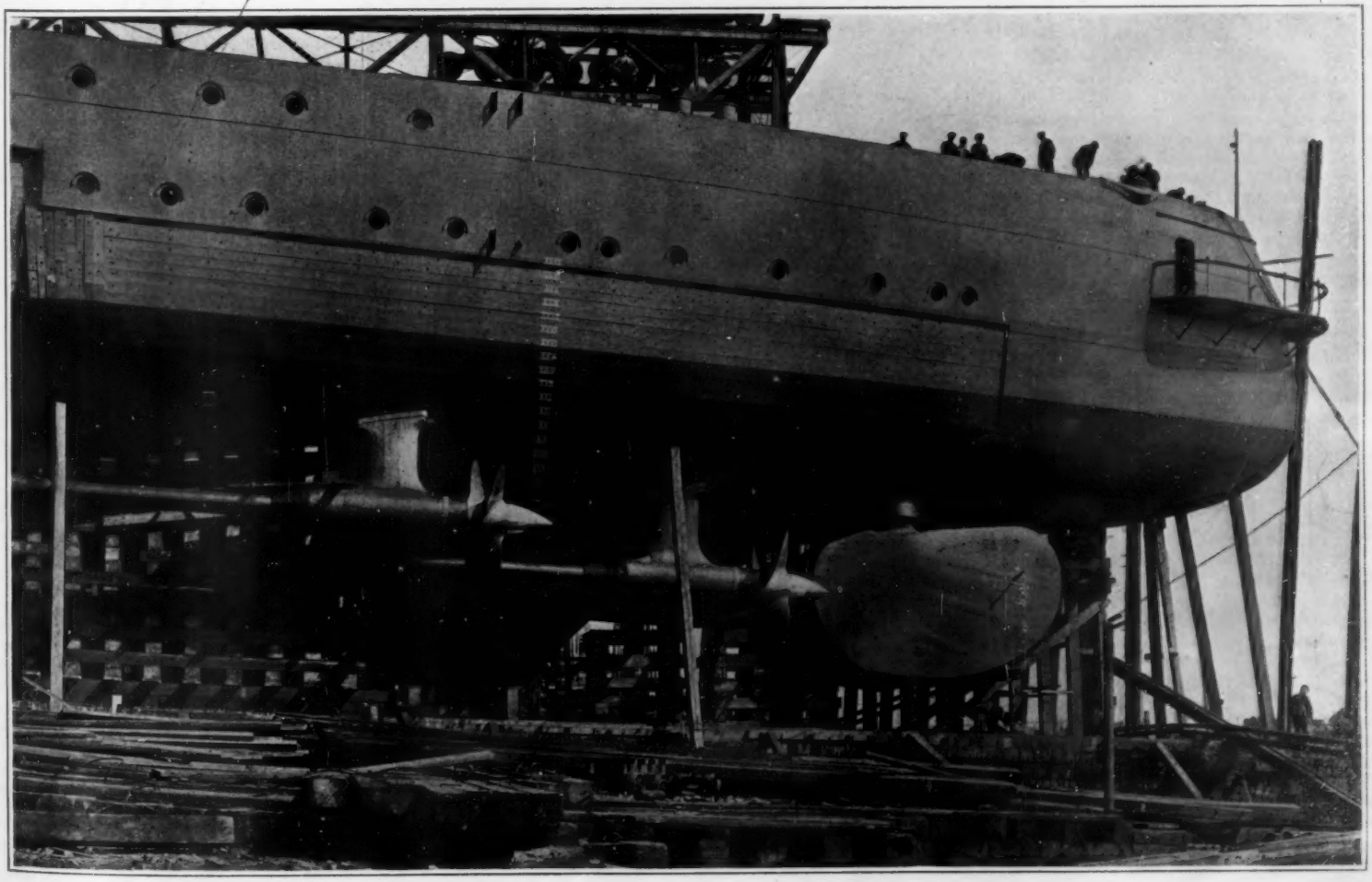
The fleets of the air seem at present then to be fully capable not only of locating but of attacking, more or less effectively, hostile under-water craft. When it is

(Concluded on page 134.)



Length, 704 feet. **Beam,** 92 feet. **Displacement,** 27,500 tons. **Speed,** 28 knots. **Coal,** 4,000 tons. **Oil,** 1,000 tons. **Guns:** Eight 14-inch; sixteen 6-inch. **Torpedo Tubes,** 6 submerged.

The new Japanese battle-cruiser "Kongo." Three sister ships building in Japan.



"Kongo" on the ways, showing two of the propellers and the port rudder.

Boots Ripped by Lightning

THE boots shown in the accompanying photograph were worn by Mr. John M. Carus of Provincetown, Mass., on June 2nd, 1862, while he was in his boat fishing. A thunderbolt struck the man and rendered him unconscious for several hours. One burn extended from elbow to wrist. Another burn ran from the neck to a joint low down upon the back. The worst burn was on the right leg. The boots that Mr. Carus wore were practically new at the time. The lightning ripped the soles from the uppers, tore apart the seams and reduced much of the leather to rags. The victim spent six weeks in the Boston City Hospital, where the doctors offered to cancel his bill of $90 in exchange for the boots, but the owner prized them too highly and kept them until his death, at the ripe age of 98.

Havoc wrought by lightning to a pair of boots.

Belgian Sand-boats

THE introduction of the sand-boat has relegated to the rear all other sports at the Belgian sea-side resorts. Whizzing by, at almost the speed of an aeroplane, these fragile boats, mounted on four bicycle wheels and displaying a great main-sail, bellied with the strong wind from the North Sea, present a picture of pleasing novelty.

The Belgian coast, from the bordering French town of Dunkirk to Flushing lighthouse, the first landmark in Holland, is an unbroken stretch of level sandy beach. Dotted at intervals of from two to four miles are fascinating resorts, built upon the famous sand dunes, for which Belgium is so noted. From La Panne, Coxyde, Oostenkirk, Nieuport—all the way to the important city of Ostend, and still farther on, to the favorite sea-side town of Blankenberghe, these white-winged sand-boats are sent out to compete in the races, up and down the coast. As the wind seldom abates, these contests are of almost daily occurrence.

Pleasure-seekers galore gather to cheer the boats from their respective resorts. On a fine day, the entire stretch of sands is an unbroken line of moving humanity. Children on donkeys, led by costumed peasant girls who patter their bare feet over the smooth, wet beach, shell gatherers and idle strollers—all of them turn to view the picturesque scene of a dozen or more phantom-like boats, sweeping abreast on land—the pennants of America as well as Belgium fluttering from their masts. Sailing by on a hurricane gale or plowing their way through a sand drift, hurling the glassy particles aloft, as a cloud of spray abeam, the passing of these boats is the signal for a spontaneous cheer that ascends and floats away across the sea, only to be echoed back, as a signal of the approaching race, to those persons farther up the strand.

Sand-boat at a Belgian sea-side resort.

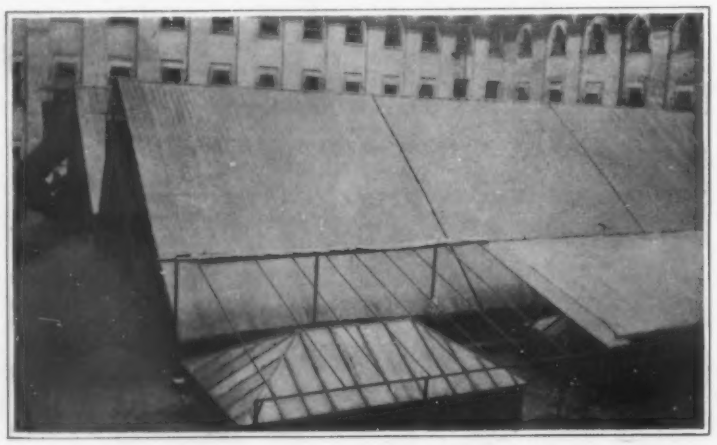
Canopied Skylights

IN the south court of the United States Treasury Building at Washington, D. C., there is a one-story building about 92 feet square, consisting of a center portion about 60 feet wide by 92 feet long, and two side wings each 16 feet by the same length. The side buildings have sloping roofs, in each of which are placed three skylights, and a ceiling in which are placed ceiling lights under the skylights, thus forming air chambers.

Over a large portion of the main room are two "saw-tooth" skylights, which open directly into the room with no ceiling beneath. There are also two rows of small skylights in the roof over the large room. These small skylights, together with those over the side buildings, are shielded by rolling canvas curtains on the outside, arranged in sections. The tin-covered sloping portion of the "saw-teeth" are shielded by fixed canvas curtains, over which water is allowed to trickle, the object being to keep the tin roof as cool as possible. These canvas curtains are placed far enough above the tin to allow a free circulation of air under them and are partially supported by a 3-inch galvanized iron pipe at the ridge of each skylight respectively. The pipe is perforated with one row of 3/16-inch holes, spaced about a foot apart. The center line through the holes is so set that the jets of water shall strike the canvas as high as possible.

Thermometric readings taken show that while the temperature on the exposed tin roof outside of the canvas is often as high as 123 to 127 degrees, and the temperature in the dry shade on the same roof at the same time is 90 to 93 degrees, the temperature of the tin under the wet canvas is from 78 to 83 degrees, and the temperature of the room below at breathing line is from 81 to 87 degrees, when the temperature of air in the shade at ground level is 90 to 92 degrees.

Building a boulevard over a sewer.



Wet canvas canopy for the United States Treasury Building skylights.

A New Copper Photographic Process

PHOTOGRAPHS upon copper plate are now made by a new process. It has been desired to use the sensitiveness of cuprous salts to light, especially for transferring engraving designs upon metal, but such images could not be fixed, as reagents dissolve the copper salts, both acted on by light or unaffected, in about the same way. By a new process, a polished copper plate is exposed to chlorine gas for a few seconds to produce a sensitive layer, then it is exposed under a negative for ten minutes in sunlight, after which a positive image is seen. The sensitive layer should be extremely thin, as a thicker layer is less suitable and is found to be in some cases twenty times less sensitive. Fixing is readily done by a toning-fixing bath containing but little hyposulphite and already charged with silver salts coming from previous use with paper toning. On the plate the affected parts take a brown hue and the rest dissolves out. Other baths can also be used. The image made by this process looks somewhat like a daguerreotype.

Building a Highway on a Sewer

JONES FALLS, often called the dirtiest sewer in America, which has followed a sluggish, devious route through the city of Baltimore ever since it was founded, is being converted into a splendid boulevard which affords an easy-grade highway from the outskirts of the city to the harbor's edge. It is called the Fallsway.

Calvin W. Hendrick, chief engineer of the Baltimore Sewerage Commission, conceived the plan, and after a long and disheartening campaign against conservative elements in the city, secured the approval of a million-dollar loan for the improvement. Work was begun immediately. The plans prepared by Mr. Hendrick provided for three conduits, each 20 feet wide, of concrete, and paved with vitrified brick, to be erected between the retaining walls of the stream. Over these a roof was designed, which when covered with a filling of earth, and paved, would form the street.

The east conduit was made deeper, and through this the water will flow under ordinary conditions. In times of storm, the gates will be opened, and the flood let into the middle chamber. Only in great floods will the third conduit be necessary. Jones Falls has a reputation for disastrous floods, and has frequently overflowed its banks.

Chief among the many and perplexing problems met in constructing the Fallsway was a great horseshoe bend which Mr. Hendrick wished to do away with. A tunnel was therefore drilled through solid rock straight across, and the stream diverted through it. All the waste land bordering the bend of the horseshoe was thus reclaimed into valuable land. Out near the borderline of the city, the channel of the stream is so deep that it is many feet below the roadway. The engineer faced a problem of raising the bed of the Fallsway to the level of the other thoroughfares. This was solved by designing a viaduct, which will rise from the conduits on gradually ascending tiers, forming an easy grade until it is on a level with the city roadway.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

New Electrolytic Alkali Cell

By John B. C. Kershaw

SEVERAL years ago Dr. Jean Billiter of Vienna invented an electrolytic alkali cell combining the advantages of the diaphragm with the bell gravity type. Since the patent on this cell was secured, it has been thoroughly tested on a practical industrial scale in Germany and Austria. At present there are five works in operation where this cell, known as the Billiter-Siemens cell, is employed, the most important of these being the Niagara Alkali Company. As described in the patent specification the cell consists of a bell 11 (Figs. 1 and 2), which is closed at the bottom by a diaphragm 2. The latter rests on an iron or nickel wire-net 3, which serves as the negative electrode. The bell stands in a vessel 10. In the inside of the bell is the anode 8, made of platinum or carbon; this is placed parallel to and at a short distance from the cathode wire-net 3.

In order to permit of a complete separation of the products of electrolysis (soda lye and chlorine), the cell is operated as follows: The bell is filled with the electrolyte to a predetermined height, while the outer vessel 10 remains, at first, empty. Since the diaphragm is pervious to liquids, the common salt solution works through to the cathode, and forms, there, soda-lye. The outlet 13 for the lye is in such a position and of such dimensions, that the liquid in the outer vessel just washes the cathode wire-net. In order to allow easy exit for the hydrogen bubbles evolved during electrolysis, the cathode wire-net (Fig. 1) may be curved, and may be allowed to abut against impervious channels 7, having openings allowing the hydrogen to escape easily; or the straight or corrugated cathode wire-net is fixed with a slightly upward slope; a slope of 1/20 is quite sufficient for the purpose. In order to raise its conductivity, the electrolyte may be warmed by a heating pipe, not shown in the drawing, and the apparatus only works well when suitable diaphragms are used. The desired result has been obtained in the Billiter cell by covering the wire-net cathode with ordinary commercial asbestos cloth 1 (Fig. 1), on which is spread a special powder diaphragm 2. According to the invention, a diaphragm composition is produced from a mixture of barium sulphate or alumina with asbestos wool, and this is made into a plastic, but tenacious and consistent mass, with a solution of common salt.

These diaphragms are stated to be extremely resistant; they will keep for months or years, and can be quickly and easily changed or renewed, as compared with the ordinary powder diaphragms. It is only necessary to remove the layer of mixed asbestos wool and powder and to substitute a new layer; this can be done in a few minutes. As an alternative the asbestos cloth may be taken out, a new one put in, and the diaphragm made up again. In air, these diaphragms after a short time, dry completely and become hard; they recover their original pliability and permeability on being placed for a short time in water, or in a salt solution.

During the electrolysis, soda-lye is formed in the vessel 10, while chlorine ions pass to the anode, are there collected, and are evolved as gaseous chlorine. Fresh solution is added through the pipe 12, which extends down almost to the diaphragm. During the electrolysis therefore, the upper part of the solution becomes poor in salt, and the lower part increases in specific gravity; as a result of this difference in specific gravity, a very sharply defined layer is formed directly above the diaphragm.

The cells may be made of various materials, such as wire-glass, or stoneware plates bedded in cement, or asphalt, as shown in Fig. 1; they can also be made of armored concrete or of stone slabs. In small cells (up to 100 amperes) it is advisable to fix the asbestos cloth to the bell. The whole bell with the diaphragm can then be placed on a corrugated wire-net, shaped to the form of the outer vessel. The bottom of this outer vessel 10 is advantageously made of sheet iron, and it then forms the conductor for the current to the cathode net. In larger cells (above 100 amperes) this plan is scarcely practical; and in such cells it is advisable to attach the cathode wire-net to the bell. In order easily to renew the diaphragm, if required, without having to take out the bell, the lid of the latter is made readily removable.

The experimental trials with this cell gave a current efficiency of from 85 to 95 per cent, with a concentration of soda-lye of 12 per cent, and chlorine gas of 99 per cent purity. In his patent specification, the inventor states that concentrations up to 10 per cent and 15 per cent NaOH can be obtained, and that a cell with a cathode surface of 1 square meter when worked at 60 deg. Cent. will take a current of 600 amperes with an E. M. F. of only 4 to 4½ volts.

The claims made for the new cell and process are: 1. That it combines the advantages of the earlier diaphragm processes with those of the bell gravity cell, and that it overcomes the chief defects of both. 2. That the causes of low efficiencies in the open type of bell-cell are checked; (*a*) by the presence of the diaphragm; (*b*) by the stratification of the liquors in the cell; and (*c*) by the direction of the flow of the electrolyte through the cell. These three conditions enable one to obtain a comparatively high current efficiency (for the type of cell) with a fairly concentrated solution of sodium hydrate at the cathode. The fact that the diaphragm is immersed in sodium hydrate solution, also contributes to its long life, and reduces the running costs of the process.

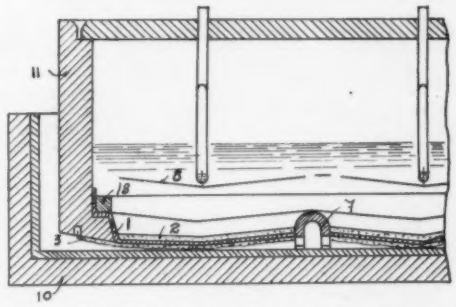


Fig. 1.—Longitudinal section of a portion of a cell.

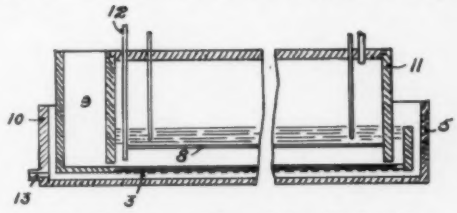


Fig. 2.—Cross-section of the alkali cell.

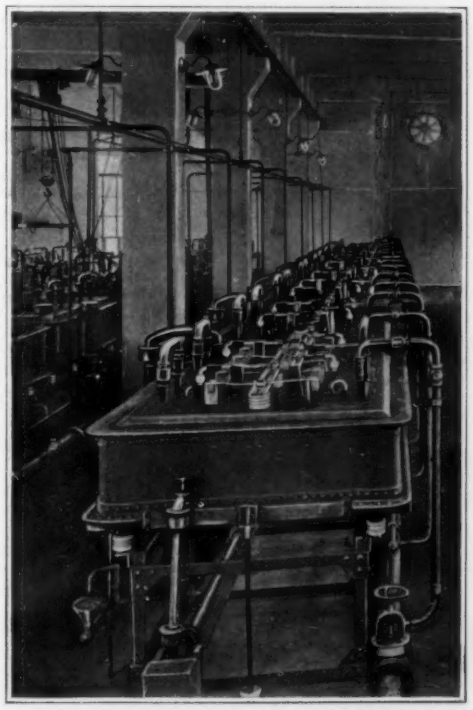


Fig. 3.—A battery of alkali cells in Krummau, Bohemia.

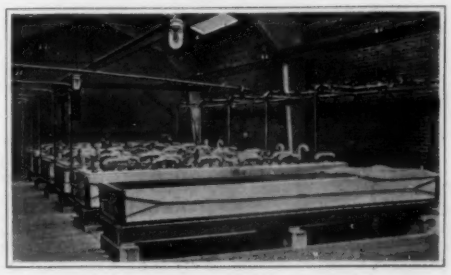


Fig. 4.—Portion of a cell room at Aschersleben, Saxony.

Notes for Inventors

Lactic Acid and Malt.—Robert Wahl of Chicago has secured patent 1,068,028 for the addition of lactic acid to malt during a stage of the manufacture. This he does by means of a liquor containing a culture of lactic acid bacteria. It is claimed that the added lactic acid lends zest to the beer and exerts a stimulating effect upon the peptase of the malt.

A Rotary Safety Razor.—George Nichols Moore of Dumont, New Jersey, assignor to Rotary Appliances Company of New York city, in a patent 1,068,068 presents a safety razor which has a blade of disk form with a continuous cutting edge rotated by suitable means in juxtaposition to a guard, means being provided for varying the space between the guard and the cutting edge of the blade.

A Mergenthaler Linotype Patent.—Patent 1,067,503 to Mergenthaler Linotype Company, as assignee of Charles C. Burdine of Washington, D. C., presents in a typographical machine, transfer means constructed to receive successively a plurality of separate lines or line sections and to forward them simultaneously, together with means to deliver them in assembled form successively to the transfer means.

An Improvement in Lace Manufacture.—John E. Dudson of River Point, Rhode Island, assignor to Harry C. Curtis of Warwick, Rhode Island, has secured patent 1,067,324 for lace and process of making same in which the lace comprises weavings of three or more colors in a single longitudinal strip. The invention provides for weaving lace curtains, embroidery braids, lace edgings and insertings with any desired colored pattern of three or more interchangeable colors.

A Sectional Lifeboat.—Benjamin F. Sargeant of Fort Worth, Texas, has secured patent 1,067,276 for hoisting and launching machinery for lifeboats, also patent 1,067,277 for lifeboat. The patent for the lifeboat shows a lifeboat of two sections which fit side by side and are hinged together at the bow so that they can be opened out end to end when on shipboard and can be folded together to form a single boat. Each section is provided with a propeller and with an engine for driving the propeller.

An Automatic Stabilizer.—Norman Clark and Albert E. Plank of Quincy, Illinois, in patent 1,067,406 present an aeroplane which has a convex curved lower surface adjacent to the front edge of the plane and extending back beyond the middle of the body of the plane and reversing into a concave surface adjacent to the rear. Thus they seek automatically to maintain stability and equilibrium in accordance with varying degrees of speed and atmospheric density and to avoid pitching.

Improving the Patent Office Building.—Some recent small fire or fires attracted attention to the defective electric light equipment of the Patent Office and have led to the installation of modern wiring systems. At the same time the main or trunk line sewers in the basement of the building are being extended to meet the increased demands and to modernize the building in this respect. New flooring has been laid in most of the examiners' rooms and a general house-cleaning is in progress. This will probably be completed when the new Commissioner, Mr. Ewing, assumes office on August 15th. It is expected that Mr. Frazier will enter upon his duties as First Assistant Commissioner on September 1st.

Two Patents to Charles Francis Jenkins.—Charles Francis Jenkins, the well known Washington, D. C., inventor, has had issued to him two patents, one No. 1,067,431, for a machine for applying caps to bottles of paper or other material, and another, 1,067,432, for an improvement in flying machines, which latter includes a rear steering vane. Heretofore in a Wright machine it has been usual to pull down the rear edge of the main plane or of the ailerons or balancing planes on the low side of the machine when it has lost its equilibrium, and to let go the other side. This has a tendency to throw the machine around off its course, and to counteract this the rear rudder is so connected as to be simultaneously moved to neutralize this turning effect.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

GARMENT HOLDER.—L. POSNER, 474 Wyona St., Brooklyn, N. Y. The principal object of the invention is the provision of a fastener having clamping means constructed and arranged to avoid presenting engaging parts or elements for entanglement with the clothing of the person wearing the fastener.

APPARATUS FOR COMPRESSING LEATHER SOLES.—F. T. MILLET, 18 Rue Gambetta, Persan, France. The present invention has reference to a very simple and useful apparatus which allows of carrying out by a laminating or rolling action, without noise and without appreciable fatigue, a compression of the leather which is also more energetic and more rapid.

Electrical Devices.

SPELLING MAIL INDICATOR.—C. H. LUTHER, P. O. Box 298, Fayetteville, Ark. This inventor provides a simple and inexpensive device for indicating the placing of mail in mail boxes, particularly on rural routes, wherein an incomplete indication is provided, adapted to be completed by the carrier or postman, to indicate the placing of the mail.

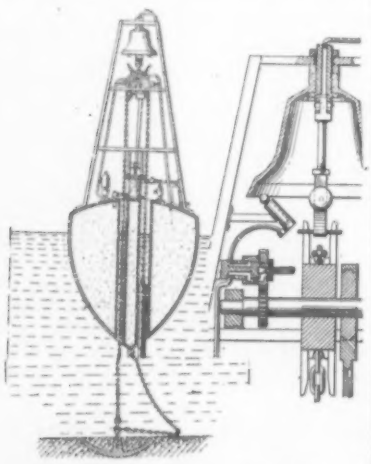
Of Interest to Farmers.

CORN HUSKER.—G. A. STEVENS, 520 Center St., Elgin, Ill. This invention comprehends a husking device in which the inventor seeks to make various improvements relating more especially to the manner in which the husks are removed from the ears and in which the ears are separated from the stalks and fodder.

FEED DELIVERING ATTACHMENT FOR SILOS.—S. M. SCOTT, care of Scott & Sons, Edna, Tex. This useful invention relates to silos, particularly to an attachment whereby the ensilage may be delivered therefrom as it is desired for use without necessitating the climbing of the silo and entrance thereinto for this purpose.

Of General Interest.

BELL BUOY.—J. GILLIS, care of U. S. Radio Station, Unalga Island, Alaska. This buoy gives desired marine signals when the water is calm or is agitated. It carries a revoluble actuator for the striker of the bell supported on the buoy, and a chain engages the actuator for turning it, and has one end fixed and the



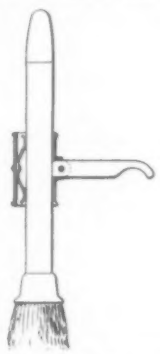
BELL BUOY FOR MARINE SIGNALS.

other end provided with a counterweight so that the actuator is turned and the striker actuated according to the movement of the buoy. Use is made of a pneumatic sounding means periodically actuated by compressed air stored in an air chamber supplied with air from an air compressor actuated through the movement of the buoy.

WALL CONSTRUCTION AND TILE OR BLOCK THEREFOR.—A. HARDONCOURT, JR., 279 Henry St., Brooklyn, N. Y. This invention pertains to walls and blocks or tiles for constructing the same, and has for an object to provide an improved construction of wall whereby the wall may be bonded in the course and the facing brick properly interlocked with the tiles or blocks forming the wall.

CHIMNEY CAP.—J. E. MCCALL, 336 S. Jackson St., Montgomery, Ala. The inventor provides a cap having a simple form and provided with means for facilitating the escape of smoke and hot gases, while preventing the wind from blowing downwardly into the chimney, and yet allowing the escape of water falling in the form of rain upon the top of the cap. The chief purpose of the inventor is to prevent sparks escaping from the chimney.

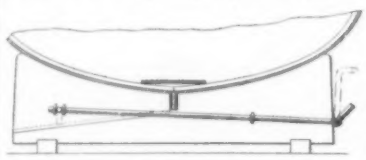
SUSPENDING DEVICE FOR UMBRELLAS.—CARROLL H. REED, 131 Windemere Ave., Eagle Rock, Los Angeles, Cal. This invention relates to a device for suspending umbrellas and comprises means for its adaptation and usefulness in the draining and drying of "the rainy day"—"the wet umbrella." Means are secured to the tip of the shank of the um-



SUSPENDING DEVICE FOR UMBRELLAS.

brella to engage or hang on the edge of a shelf, door—in fact, anywhere to drain from the points of the bows. The engraving illustrates the outer end of an umbrella, showing one of the suspending devices detachably secured thereto.

BOAT CHOCK.—W. S. ROGERS, Box 59, Newport, R. I. This invention has particular reference to means for supporting life-boats upon decks of vessels in connection with the usual davits or for supporting any other kinds of



BOAT CHOCK.

boats. The boat support or chock is of a peculiar nature, whereby a life-boat, for example, may be operated from the davits and easily and quickly lowered to the gunwale without the necessity of first hoisting the boat in order to clear the chock or enable any portion of the chock to be removed from normal position.

SPOOL BEARING.—J. E. NACE, 11 Carlesle St., Hanover, Pa. Bearing sockets comprise semi-circular members with ends thereof in the forms of spurs integral with the body of the socket, the material being bent diagonally at the base of the spurs and then at substantially right angles at points inward from the

SPOOL BEARING.

diagonal lines, the ends of the bearings thus presenting return-bent members and members beneath the return-bends, the spurs projecting from the last named members and also projecting beyond a side edge of the socket approximately parallel with one another, and with the axis of the socket. The invention relates more particularly to means for supporting spools in cabinets adapted to display lace and insertion.

Hardware and Tools.

LOCK.—G. E. GAUNT, Latonia, Covington, Ky. Mr. Gaunt's invention is an improvement in locks, and the object is the provision of a simple device having a spring operated bolt, which may be retracted manually or by a key, and which may be locked in extended or retracted position.

CROSSCUT SAW HANDLE.—CHARLES M. MINTON, Philomath, Ore. The primary purpose here is to provide a light construction and by which a saw may be readily and quickly clamped and the angular extension of the handle as readily and quickly adjusted with respect thereto, all without the necessity of screw bolts and other parts requiring the use of additional tools.

Heating and Lighting.

AUTOMATIC HEAT REGULATOR.—A. P. BROOMELL, 133 N. George St., York, Pa. An object here is to provide means controlled by a thermostat for operating the valves and for effectively locking the valve in its closed position, thereby resisting pressure tending to open it, but which will automatically operate to release the valve and to withdraw it from its seat when the temperature has reached a certain point.

STOVEPIPE FASTENER.—B. M. SMITH, Monroe, Ind. The fastener has two elongated members, one with an opening in its outer end, and the other with an attenuated inner end of spear head shape projecting through the opening, the members being in inter-locking engagement with each other at the spear head and opening, each member having a hook at its other end for engaging a stovepipe section and the inner wall of the chimney, there being a plate with an opening through which one of the members is dispersed, and having a flange at its outer end to serve as a stop for the end of the stovepipe, and a flange at its inner end to rest against the outer wall of the chimney.

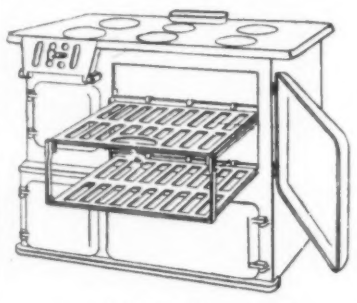
Household Utilities.

WINDOW SHADE FIXTURE.—A. DANGLO and L. RESCH, 175 Clinton St., Brooklyn, N. Y. The invention provides runways for the edges of a window shade to protect and guide the same as raised and lowered and in service position; provides means for preventing the escape of shades and the consequent excessive rolling of the automatic attachment; and provides means for arresting a shade in its flight, without damage thereto.

WINDOW CLEANING DEVICE.—PRISCILLA ALSBERG, 80 St. Nicholas Ave., New York, N. Y. The purpose here is to provide a device which is simple and durable in construction, readily applied to a window, and arranged to permit of conveniently and thoroughly cleaning the window panes on the outside thereof, by the operator manipulating the device from the inside of the window.

KITCHEN REMINDER.—F. A. BERTRAM, 1669 Woodbine St., Brooklyn, N. Y. In this instance the invention has reference to improvements in kitchen utensils designed to enable the cook or housewife to keep herself informed of the state of the pantry, and to remind her when the supply of a given commodity or grocery is running low and is in danger of being exhausted.

WITHDRAWING SAFETY OVEN.—S. H. CHRISTIAN, Cedar Grove, N. J. By this invention Mr. Christian has made it possible to do all the household cooking without putting a hand inside of the oven. A light pull on the detachable crossbar draws the skeleton frame



WITHDRAWING SAFETY OVEN.

entirely outside of the range, the open sides, end and top make it easy to put the cooking in place, do all turning, basting and finally removing all from the oven without danger of burning hands or arms. A sheet-metal shield, full size of the oven and attached to the rear of the skeleton, completely fills the opening and retains the oven heat while the skeleton oven is withdrawn.

Machines and Mechanical Devices.

ALARM.—J. B. WILLSEA, Fruita, Colo. The invention refers more particularly to the combination with an alarm clock having alarm-operating mechanism, of a gravitationally operable reservoir for fluid adapted to drip upon the person of the sleeper to awaken him, and means for maintaining the reservoir in a normally inoperable position, the last mentioned means being releasable by the alarm-operating mechanism.

DRILL CHUCK.—E. H. MONAGHAN, corner 8th and Hawthorne Avenues, Richmond, Cal. This invention has reference to chucks, such as are adapted for use upon drills and lathes, for the purpose of securing a bit or other transient revoluble tool in position to turn upon its axis in order to operate upon a piece of work to be cut or drilled.

CALCULATING MACHINE.—H. GOLDMAN, care of Arithstyle Co., 118 E. 28th St., Manhattan, N. Y., N. Y. The present invention provides a machine arranged to enable the user to obtain a good leverage at any point of the operating surface for depressing the chain prior to imparting a traveling motion to the same, and to properly connect the chain with the associated numeral wheels, thus insuring an accurate and easy working of the machine.

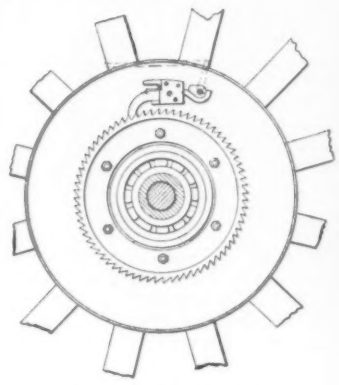
Railways and Their Accessories.

RAIL FASTENER.—W. E. O'BRIEN and E. J. QUINN, 314 Chicago St., Kenosha, Wis. This device comprises a bearing plate having means for clamping the rail in a predetermined position on a railway tie. An object is to provide a fastener by means of which the rail can be easily and quickly attached to the tie; and one such that the bed supports the rail and carries the gripping means, preventing the lateral displacement of the same.

PORTABLE RAILWAY CRANE.—WOLFGANG SCHRADER, Berlin, Germany. This invention relates to a novel portable railway crane with a movable boom pivotally connected by means of three pairs of links with a frame, which is turnable on the carriage around a vertical main pivot. The crane is so constructed that the boom can be moved forward for work and moved rearward for the transport of the crane.

Pertaining to Vehicles.

BACK STOP FOR VEHICLES.—J. H. ADAMS, Taft, Cal. The invention relates more particularly to a device mounted on a wheel of a vehicle comprising a rotating member, a pivoted member, and means associated with same to control the engagement of the two



BACK STOP FOR VEHICLES.

members whereby the backing of a vehicle is prevented. An object is to provide a reliable back stop which can be easily attached to the wheel of a vehicle and provided with a controlling lever or pedal for the operation of the device by the driver when desired.

LIFTING JACK.—W. W. BELL, Valley Springs, S. D. The object here is to provide a jack designed for the purpose of lifting wagons and the like, which is simple of construction and easy to operate and capable of adjustment to suit all varying conditions as they are met with in actual practice.

WATER COOLING RADIATOR.—W. J. KELLS, 267 Armstrong Ave., Jersey City, N. J. This inventor provides means for delivering water to an air-draft-cooled radiator in such a manner as to cause the entire water to pass within the radius of the air-draft; provides means for delivering water to a tubular radiator so as to direct the flow in contact with the tubes having the maximum refrigerating quality; and provides means for reinforcing the construction of the radiator.

Designs.

DESIGN FOR A JEWEL MOUNTING.—H. ACKERMAN, care of J. C. Nordt, 51 Maiden Lane, New York, N. Y. In this ornamental design for a jewel mounting, the plan view shows edge of the mounting made up of six semi-circular forms, the center of the whole design showing a six-pointed star-shaped opening. Mr. Ackerman has designed another jewel mounting on nearly the same outlines as the above, but has added the upper half of a T-shaped design projecting from the outer edge of the semi-circles.

DESIGN FOR A DUSTING CAP.—J. TWINEM, 220 Ashford St., Brooklyn, N. Y. This ornamental design for a dusting cap is round in form. The front edge of the cap is ornamented with a scalloped bordered band.

DESIGN FOR A DOLL.—ROSE O'NEILL WILSON, care of O. F. Wood, 17 W. 38th St., Manhattan, N. Y., N. Y. In this ornamental design the figure of the naked doll is in a sitting position. The large head nestles at the jaws in the palms of the child's hands, the arms being bent to rest on the raised knees. A very small pair of wings grace this quaint and attractive figure.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Comparison of French and German Strength in Dirigible Airships

(Concluded from page 126.)

If the actual status of this aerial fleet is secret, that of plans and projects is doubly so. French inferiority is obvious, and also French efforts to diminish that inferiority.

La Nature goes on to state that to strike a proper balance between dirigibles and aeroplanes, the great merits of dirigibles—their radius of action and ability to scout at night—with their immense defects—fragility, difficulty of taking on stores and charging, hazardous landing, cost, etc., must be considered.

"We must not forget the terrible series of catastrophes to which nine of the great dirigibles have succumbed, nor the resultant financial loss, nor what a corresponding sum might do for us if applied to aviation," says our French contemporary.

The remainder of the article deals with other countries.

RUSSIA.—Russia has a much more formidable fleet of dirigibles than is generally supposed, and may be considered as the third air power in Europe. The military school of aeronautics alone has five dirigibles. Besides, there have been ordered the "Albatross," 10,000 cubic meters with a speed of 60 kilometers per hour, built by the National Iorsky factory; the "Astra XIII." (French) and the "Clement-Bayard VI.," which are now having their final tests (9,600 cubic meters, 260 horsepower, 13.5 meters diameter, total length 86 meters).

ITALY.—Up to last year Italy had only five small dirigibles ("P1," "P2," "P3," "P4," "P5," of 4,500 cubic meters capacity and 50 kilometers per hour speed). But she has recently built two of 12,000 cubic meters capacity ("M1," "M2"), and the M series is to be continued with "M3," "M4," and "M5," having the same characteristics, i. e., the remarkable speed of 70 kilometers per hour, an ascensional ability of 2,000 meters altitude, a radius of action of 1,000 kilometers, engines of 500 horse-power, and ability to stay aloft 35 to 40 hours. Italy, with its five factories at Rome, Milan, Campalto, Verona, and Bracciano, is trying to create a powerful aerial fleet. (A sixth factory is building at Ferrara.)

A third series, G, whose construction has been decided on, and of which the first will be ready this year, will equal the great German cruisers in gas capacity (24,000 cubic meters) and surpass them in speed (100 kilometers per hour), if the plans of Forlanini and Major del Fabbro work out as expected. The engines provided to insure this sensational speed are of not less than 1,000 horse-power. (A dirigible named "Citta di Milano," built at Baggio, of 24,000 cubic meters capacity and 50 kilometers per hour speed, is designed, it is said, to undertake the crossing of the Atlantic. In short, the Italian construction is sufficiently remarkable for the German officers to be following its progress closely.)

AUSTRIA-HUNGARY.—Austria, which has had no aerial fleet, has recently tried to acquire a Zeppelin from Germany, but Count von Zeppelin has publicly declared that he will not build vessels for any other country than Germany.

ENGLAND.—At present England possesses no dirigibles of great tonnage. Its small dirigibles are remarkable for their ingenious mechanism, notably the oriented propellers. The British Admiralty has just ordered two dirigibles of 10,000 cubic meters capacity, making at least 65 kilometers per hour. One will be of the Astra-Torrès type, the other of the Parseval type.

The smallest dirigible in the world, the "Baby," a mere bamboo rod suspended from a gas-filled envelope and carrying a motor of 35 horse-power only, belongs to England. It exceeds 80 kilometers per hour. Its military value is questionable. The great naval dirigible "Mayfly" was destroyed at Barrow in 1912.

The preceding data have been obtained by *La Nature* from the comparison of a great number of documents, but so scanty and so often contradictory are they that

The Visibility of Submarines

(Concluded from page 129.)

remembered that the submarine is unarmored and relatively slow, that in war its cruising depth and that at which it must attack do not exceed the draught of a battleship, that aeroplanes can readily overtake it, hover over it singly or in groups, and deliver a flood of missiles on its hull, perhaps before their presence is known, the battle, for the under-water terror, seems unequal. If warned in time, its only recourse is sudden and deep diving, like a fish fleeing from the talons of a hawk. With its low speed and the power of the aviator to scrutinize a wide area, the duration of these tactics seems limited. Aeroplanes working in conjunction with torpedo-boat destroyers in attack on submarines would seem to the old sailor much like that most sanguinary tragedy of blue water, the assault on the helpless whale by the sword fish and that wolf of the seas, the thresher, in which the missiles of the aeroplane would take the place of the thresher's savage blows.

Despite these adverse conditions, the submarine is far too powerful and deadly a weapon to be eliminated from naval warfare. At night or in foggy weather, it is wholly safe from aerial enemies, and, under these sheltering screens, it can still feel its way to its target, while, if duty called, there will always be plenty of brave men afloat who would dare the dangers of the sunlight to steer it to attack. Finally, when we review the swift progress in the enginery of war on the sea during the last twenty years, it seems impossible that the genius of inventors will not find a way to conserve the submarine's fighting value, either by protecting it from its aerial foes or by enabling it to meet them on more nearly equal terms. The problem is doubtless engaging the earnest attention of naval experts.

John Milne

THE recent death of Prof. John Milne removes from the English scientific world one of its most conspicuous figures. If not altogether the creator, Milne was at least the earliest leader of the "new seismology;" i. e., earthquake-study as a branch of physics, rather than of descriptive geology.

Milne began his career as a mining engineer, and after a good deal of wandering over the earth in that capacity found anchorage in the little colony of scholars and experts who were engaged in imparting occidental knowledge to the newly awakened people of Japan. He began a twenty years' residence in Japan in 1875, when he was 25 years old. Here, as he has himself expressed it, "they had earthquakes for breakfast, dinner, and supper, and to sleep on," so that his curiosity could not fail to be aroused by this obtrusive phenomenon of nature. At length, in 1880, a particularly disastrous shake inspired him with the idea of organizing the world's first society for the study of earthquakes—the Seismological Society of Japan. The pioneer work carried on by this organization placed the science of seismology on an entirely new footing, especially since it included the development of the first accurate instruments for recording and measuring earth movements. As honorary secretary of the society for fifteen years, Milne was its leading spirit. He early recognized the importance of erecting seismographs and seismoscopes at as many places throughout the country as possible, and before the end of his tenure of office in the Orient he had created a Japanese network of 968 stations—a far greater number than are found in any other country.

In 1895 Prof. Milne with his Japanese wife returned to England and took up his abode at Shide, in the Isle of Wight. In this quiet retreat he continued his chosen work, but now with a broader outlook, for he soon set himself to the task of organizing, on behalf of the British Association for the Advancement of Science, a seismological survey of the world. The need of an international organization had become apparent with the discovery that strong earthquakes make themselves felt all over the globe and cannot be adequately studied merely as local phenomena. At the same time he worked hard at the improvement of seismographs, with a view to providing an ideal and uniform equipment for the international stations. The great memorial of his activities since 1895 is found in the series of reports of the Seismological Committee of the British Association, of which he was secretary and prime mover up to the time of his death.

The Death of S. F. Cody

COLONEL S. F. CODY, an American by birth, but a naturalized English subject, a figure long prominent in the world of aeronautics, came to a violent end on August 7th. He and a passenger named Evans were killed while flying in Cody's monoplane at Aldershot. The cause of the accident could not be ascertained; for the machine dropped from a height of two hundred feet and was reduced to a mass of tangled wreckage.

Cody was first heard from as a designer and builder of kites. So successful was he in his province that his work attracted the attention of the English military authorities. In his very original investigations, he succeeded in towing boats through the water with the aid of kites and even made the attempt to cross the English Channel in that fashion. In 1905 he succeeded in elevating a man to a height of 1,133 meters by means of kites.

The construction of the mechanical portion of the British military dirigible "Nulli Secundus I." was of his design.

Cody was one of the pioneers in aviation. In 1909 he constructed a biplane with which he flew 420 meters on May 14th at Aldershot. After various mishaps, he succeeded in making long flights by the end of 1909. Indeed, he was one of the first of long-distance flyers. As early as August 9th, 1909, he covered 75 kilometers and came down only for lack of fuel. On November 4th, 1910, he covered 110 miles in two hours and twenty-four minutes. With an improved biplane of his own construction, he took part in the English circuit of 1911, but without accomplishing anything wonderful.

Cody had entered in the London *Daily Mail* $25,000 prize race around the British coast, and for this purpose had constructed a new hydro-biplane with a span of 60 feet.

The Current Supplement

THE volcanic character of the Japanese Islands raises altogether peculiar problems in building construction. How these are met by scientific methods is told us by Blackford Lawson in the current issue of our SUPPLEMENT.—Prof. O. W. Richardson furnishes experimental proof that the electric current in metals is carried by electrons.—B. Thieme describes the production of lampblack by electrical precipitation.—D. A. Willey tells us of the heroic work of the English army medical service in combating that scourge of Africa, the sleeping sickness.—The Schoop process of metal-coating surfaces is described by Dr. Lach.—J. A. Hill tells us some remarkable facts about that mysterious aspect of the human mind, the subliminal or subconscious self.

A Combination of Speech-recording Devices.—Franz Ewald Thormeyer of Hamburg, Germany, has secured a patent, No. 1,063,085, for an apparatus designed for the recording and reproducing of lengthy speeches and compositions in which there is combined a number of successively operated recording or reproducing machines together with means which are automatically controlled by the operation of one of the machines for starting the operation of another such machine, so the machines can be successively operated.

A Record Cross-Country Flight with an American Military Monoplane

AFTER having thoroughly tried out his machine at the Hempstead Aerodrome, Mr. C. Murvin Wood made a record long-distance flight from that field, located near Garden City, L. I., to Gaithersburg, Md.—a distance of 225 miles—on the 8th inst. Mr. Wood intended to fly to Fort Meyer, Va., but he was unable to arrive there because he lost his way, and also because the motor failed him. He eventually landed at Fort Meyer at 5:45 P. M. of the same day, however.

The start of the flight was at 4:30 A. M., simultaneously with the start of a special train over the Pennsylvania lines from Jersey City. Wood rose to an elevation of about 3,000 feet while traveling to Belmont Park, and thence out over the Atlantic Ocean. Only when his motor stopped and he descended about two thousand feet, was he able to discern the sea beneath him through the fog. Fortunately the motor re-started again, and, by turning to his right, he was able, only however after ten minutes had elapsed, to regain the shore at Coney Island. He must have been fully ten miles out to sea. Without losing his nerve, he steered across New York Bay and crossed Staten Island, entering New Jersey near New Brunswick. Following the railroad, he passed around Trenton at 6:56 A. M., and continued southward, circling around Philadelphia, as he feared his engine might stop again. The special train stopped at Philadelphia a half hour to ascertain Wood's whereabouts, and Wood passed the train during this time. From his time of passing various points the men on the train estimated his speed as from 58 to 63 miles an hour, and although the train made record speed to Washington, frequently traveling over 90 miles per hour, it seemed impossible to catch the fleeting aeroplane. Upon arrival at Washington, the occupants of the train found that Wood had descended at Gaithersburg. Wood's mechanic was taken to him and repaired the engine. He found the trouble was faulty ignition. Wood reached his greatest elevation—7,350 feet—at Havre de Grace, Md., but from this point his engine began missing badly until it finally stopped completely after he had descended gradually to about half the above mentioned height. A southeast wind had drifted him toward the west, but he figured he could see the Potomac River and follow this southeast to Washington. It was with difficulty that he could discern the railroad tracks, which looked like threads, and he lost these altogether after circling around Baltimore, which city appeared as a black smudge below him. With 25 gallons of fuel in his tank at the start, Wood had some 4 gallons remaining after his 4½-hour flight. Nevertheless, he obtained 5 gallons extra from Fort Meyer, and, starting at 5:30 P. M., he covered the remaining 20 miles to that point in a quarter of an hour and volplaned from 6,000 feet in two graceful descents until he landed upon the parade ground. The machine is to be given special military tests, after which Wood may return by the air route to Hempstead. It is noteworthy that this machine, known as the Kantner-Moisant monoplane, since it was designed by Harold Kantner and constructed by the Moisant Company, worked perfectly throughout this long flight, whereas the failure of the 50 horse-power Gnome motor was the cause of the descent before Fort Meyer was reached. Until an absolutely reliable aviation motor is produced cross-country flying can never be accomplished with absolute certainty.

An Individual Shaving Cup for One Use Only.—A shaving cup described as made of paraffin paper with the inner face of the walls and bottom coated with a thin layer of soap sufficient for a single shaving is shown in patent No. 1,063,644, to Edwin O. Blanchard of Randolph, Vt. The cup can be used once and then thrown away so that in a shop an individual cup and an individual soap can be used with each customer.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12837) A. W. B. asks: I have noticed for some time in the southeast heavens at night what apparently is a star, but through a strong glass it appears to be a round ball of light, which might be similar to a very large arc light in color. Can you give me any information as to what this light is? A. The heavenly body which you see in the southeast in the evening, and which is visible all night, setting in the west in early morning, is the giant planet Jupiter. If our readers will follow the valuable and interesting articles on the Heavens in the last number of each month, the aspect of the sky for the next month will have a new charm for them. The article for July was most interesting. It stated also that Jupiter was evening star for the month and visible all night.

(12838) H. F. W. asks: Could you, in your Notes and Queries, kindly give me the scientific explanation of the principle in the following experiment: Stick a pin through the center of a calling card, then insert pin in bottom of hole in ordinary thread spool and blow steadily through other end. The card will adhere to bottom of spool. The harder you blow, the stronger is the force that presses it toward the spool. A. In the experiment with the card and spool, which you describe, the air is forced to spread out by the card as it emerges from the spool, and as it flows slower in the larger space its pressure is diminished. There is less pressure on the inner side of the card than on the outer, with the result that the air on the outside presses the card forcibly against the end of the spool. The same effect may be seen in a water jet of the form known as the ball nozzle. The ball is pressed in against the conical end of the nozzle and the stream of water is spread over a large space.

(12839) E. G. S. asks: 1. What proportion more air does a person or animal breathe when asleep than when sitting down awake or standing? A. A person or animal requires less air when at rest than when active; when asleep than when awake. We think you must have inadvertently written "more" when you intended to write "less" in your question. During sleep less carbon dioxide is eliminated, and so less oxygen is required. The heart beats less rapidly, and the breathing is not so deep. We breathe from the thorax in sleep, and not from the abdomen. We have not seen any figures as to the different proportions of air used in different conditions. 2. Please describe the phenomena of sunrise and sunset and the apparent movements of the sun in the sky, with time occupied by each, at the north pole or south pole. A. As seen from a pole of the earth, the sun circles the heavens during 24 hours of a day, remaining at the same distance from the pole, excepting for its change of declination. This change is slow near the solstices, and most rapid when the sun is crossing the equator, March 22nd and September 22nd. Omitting refraction, the sun would on these dates be half above and half below the horizon. By reason of refraction the sun will rise at a pole a day or two before the equinoxes. It will also be more than a day from the time when the upper edge of the sun appears till the entire disk is above the horizon. 3. How do you explain the cause of the following peculiar phenomena? By scratching a phosphorus match in a dark room until it glows but does not light, and then holding it against the skin over an artery, say in the wrist or hand, the match is seen to brighten or glow at every pulse beat at the moment the pulse exists at that point, and after a minute or less the flicker gradually lessens and stops until the match head is again rubbed and made to glow; while in some cases it glows at the last only for every alternate pulse beat, and finally only for every third one. Can it be proven that the very small increase in heat at the point of contact when the pulse passes it is the cause of the phenomena? A. We have not been able to repeat your experiment with the phosphorus of a match and the pulse. It does not seem necessary to suppose that heat is the cause of a brighter glow of the phosphorus. It would seem sufficient to suppose that the stirring of the skin by the pulse brings the phosphorus into contact with more oxygen of the air and thus produces more light by the larger chemical action. By rubbing the skin where the match had been pressed against the skin we were able to make the glow appear many times. Simply pulling the skin so as to stretch it produced the glow. We think this shows that the larger access of oxygen to the phosphorus causes the greater glow. 4. Has M. Blondlot, who several years ago announced the alleged discovery of the so-called "N-rays," admitted he was in error as to proving their existence? And do scientific men in general agree that the "discovery" was based on erroneous observations? A. We have not heard anything about N-rays for a long time. Probably they do not exist. What their eminent discoverer thinks at present we do not know. Scientific men were always very skeptical about them.